Canada. Fuel Controller
Final Report

1919

THE FINAL REPORT OF THE FUEL CONTROLLER CANADA

1919

OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1919

To His Excellency the Duke of Devonshire, K.G., P.C., G.C.M.G., G.C.V.O., etc., etc., Governor General and Commander in Chief of the Dominion of Canada.

I have the honour to lay before your Excellency the final report of the Fuel Controller for Canada.

I have the honour to be, sir,

Your Excellency's most obedient servant,

A. K. MACLEAN,
Acting Minister of Trade and Commerce.

OTTAWA, March 28, 1919.

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The Hon. A. K. MACLEAN, M.P.,

Acting Minister of Trade and Commerce,

Ottawa.

SIR,—I have the honour to submit my final report as Fuel Controller from the establishment of the office in June, 1917, to date.

I am, sir,

Your obedient servant,

C. A. MAGRATH.

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PREFACE.

It will be observed that this report is divided into two parts. The first deals with the fuel situation in Canada during the war; the second attempts to forecast fuel conditions of the future, with particular reference to means of promoting the conservation of coal, which doubtless will be a matter of supreme importance as time passes. The first Part is merely of historical interest, except in the lessons it may convey, and the light it may throw on the fuel problems of the future. The second Part presents a summary, based on known factors, of the probable fuel situation of the future in this country. Methods are discussed involving greater use of the country's fuel and power resources—all more or less in the formative stage, yet requiring close attention in the immediate future, so as to avoid the least possible experimental work by communities, and which frequently means wasteful expenditures.

From the standpoint of supply alone, there is no doubt as to the adequacy of our country's fuel resources to meet all future needs. The immediate problem is one of conservation, including the elimination of waste in our homes as well as in our factories. In the solution of this very important problem, the women of Canada may be expected to take a leading part. Remembering the splendid practical work they performed during the war, and recognizing that, while retaining their grip on domestic problems, their influence will, as the years go by, be increasingly felt in public affairs, I feel that I may safely appeal to them, not less than to the men of Canada, to seriously study the facts set forth in this report and to help to apply the lessons of the past to the problems of the future.

C. A. MAGRATH.

Ottawa, March 28, 1919.

PART ONE.

FUEL CONTROL IN WAR TIME.

I. INTRODUCTION.

World Survey

Modern civilization has, in a large measure, been built on a foundation of coal. As long as nothing occurred to seriously disturb the normal operation of the world's industrial and commercial organization, very little public attention was given to this vital underlying factor in industrial progress. Notwithstanding the fact that the first movement in Germany's military campaign was a drive on the coal-fields of France, the Allies appeared to be slow in realizing the significant part coal was to play in the struggle to follow. The immediate demand for munitions on an ever-increasing scale and for supplementary war materials and supplies of all kinds, as well as for motive power required for the urgent transportation of materials and troops, multiplied the world's coal requirements. In spite of this growing demand, the production of coal in the allied countries began to fall off, as will be seen from the following table:—

TABLE Showing Production of Coal by the Allies (Short tons).

—	1913 (Basic Year)	1914	P.c.	1915	P.c.	1916	P.c.	1917	P.c.
	Tons.	Tons.		Tons.		Tons.		Tons.	
United States.	569,960,219	513,525,477	90·1	531,619,487	93 2	590,098,175	103·5	652,000,000	114 3
Great Britain.	321,922,130	297,698,617	92·4	283,560,980	88·0	287,118,153	89·1	275,000,000	85·4
France.	45,108,544	32,765,156	72·6	21,899,781	48·5	24,040,000	53·2	30,800,000	68·2
Russia.....	35,500,674	36,414,560	102·5	31,158,400	87·7	33,550,000	94·5	20,000,000	56·3
Belgium	25,196,869	19,000,000	75·4	15,691,465	62·2	15,000,000	59·5	15,000,000	59·5
Canada.....	15,012,178	13,637,529	90 8	13,267,023	88·3	14,483,395	96·4	14,046,759	93·5
Total.	1,012,700,614	913,041,330	90·1	897,197,136	88·5	964,289,723	95·2	1,005,846,759	99·3

NOTE.—1913 is taken as the basic year in computing the percentages of production in other years.

One of the principal reasons for this slumping off was the loss of man-power transferred from the mine pits to the ranks of the allied armies. In the province of Nova Scotia alone, during the early days of the war, 6,000 experienced miners volunteered for service. The case of France, in particular, was greatly aggravated in that her principal mining districts were invaded by the enemy. As Marshall Foch has poignantly said, "Coal is the key to victory." It was becoming more evident as the war progressed, that its successful conclusion largely hinged on the making up of the resultant deficit between the increased requirements and the decreased supply of coal. One great source of supply, however, still remained—it was "up to America!"

Conditions which led up to the Necessity for Fuel Control

Canada possesses an abundance of good coal. Its coal fields, however, largely lie at the extreme ends of the country, one on the Atlantic coast and the other on the Pacific seaboard, with an extension eastward across the Rocky Mountains on to the western plains. It is of interest to note that the coal areas in the neighbourhood of both coasts,

have in recent years been supplying increasing tonnages to contiguous American territory. The central portion of Canada, composed of the two most densely populated provinces, Ontario and Quebec, in which the country's main industrial development has taken place, and which requires approximately 50 per cent of the total amount of coal consumed in Canada, is without any known workable coal deposits. In consequence, Canada's principal industries, together with the larger percentage of its population, are in a large measure dependent for fuel upon the coal areas in the republic to the south. The market in Canada is, therefore, susceptible to all the changes in mining or transportation conditions of the United States. In normal times, consumers both in Canada and in the United States have found no serious difficulty in securing adequate supplies of fuel. This situation remained effective for many months after the outbreak of of the war and, during this period, operators in both countries were actively engaged in seeking a market. In the meantime, preparations on a growing scale for the manufacture of munitions and other war materials were rapidly being concluded and factories throughout both countries were speeding up, many of them running first two and then three shifts per day. During the winter of 1916-17, as a result of this increasing industrial activity, it became evident that available reserves were rapidly approaching exhaustion and that the United States operators, if left to their own resources, would soon be unable to cope with the situation.

The Appointment of a Fuel Controller

The history of the coal trade is, that the market has been highly reactionary to the slightest deficit or surplus that might become evident between the supply and the demand. During the period in question, as the certainty of a shortage became more apparent, prices in the United States continued to move upwards, finally soaring for a few months to unprecedented heights, when in midsummer of 1917 they were adjusted and fixed by order of President Wilson. In view of this condition and of the increasing uncertainty and complexity of the situation in general, of which transportation difficulties were a leading feature, the Dominion Government, on June 11, 1917, announced the appointment of a Fuel Controller, whose duties were extended from time to time. His principal responsibilities were outlined by order in council, dated July 12, 1917, as follows:—

1. To examine into the coal situation in Canada:—

(*a*) As to the probable demand for consumption therein for the coming season.

(*b*) As to the output of Canadian coal that can be relied upon towards meeting these demands and what, if any, measures can be adopted to increase this output.

(*c*) As to the sources outside of Canada from which the deficiency can be provided, and the possibility of obtaining the necessary amount.

(*d*) As to the possibility of providing sufficient transport for the carriage of both Canadian and foreign coal from the points of production to the distributing points.

(*e*) As to the possibility of early and continuous co-operation between producers, carriers and consumers, with a view to economize and facilitating the needed supply.

2. That in the course of, and in connection with such investigations, the Fuel Controller be authorized to confer with and co-ordinate the different interests, with a view to insuring, so far as possible, a sufficient supply of coa

for Canada's requirements during the approaching autumn and winter seasons, and from time to time to report and recommend to the Government ways and means for effecting the same.

3. That the Fuel Controller be authorized to make regulations, subject to the approval of the Governor in Council, governing the price of coal, wood and gas, and the production, distribution, sale, delivery, consumption and use thereof.

II. POLICY.

Central Problems

The question of meeting the local coal requirements of individual householders in each community from Halifax to Vancouver was a tremendous problem which had to be faced. Not only did the conditions in each province differ, but there were also may local variations to be taken into account, such, for instance, as increase in population at certain points due to the establishment of war industries. The necessity of choosing between two alternatives in the creation of an organization, therefore, presented itself. Either an emergency administration, reaching from the Atlantic to the Pacific and entailing tremendous cost as well as involving loss of considerable valuable time, had to be established; or some of the responsibilities for looking after the local fuel requirements of their own people had to be thrown upon the already existing provincial and municipal machinery. The latter course was considered far more economical and efficient as well as time saving and was, consequently adopted.

Type of Organization Adopted

An erroneous impression seems to have prevailed in some quarters as to the purpose of the Fuel Control organization. It was never the intention to create a permanent institution; nor, in fact, to provide a temporary administration which would embarass the established agencies or supplant the existing channels of the coal trade. On the contrary, it was recognized that those agencies were conversant with the coal business, and knew where and how to get coal, and the policy, therefore, was rather to create an emergency establishment which would co-ordinate and direct the activities of the Canadian coal operators, importers and dealers, to the end, that the country would be safely carried through the inevitable stress and trial, at a period when the whole world was passing through a great crisis; and that it would be carried over the peak of the mid-winter season, at once the period of greatest demand and lowest flow of coal, so that the wheels of industry would not be stopped nor the people suffer hardship.

Personnel

A limited staff at the Central Office was, of course, a necessity. The position of Deputy Controller was filled by the appointment of Charles W. Peterson, with T. H. Cunliffe as chief clerk. At that time Mr. Peterson was closing out the work of the National Service Board, and his staff and office equipment were transferred to the Fuel Control organization. The personnel was augmented from time to time and, when completely organized, the Fuel Controller's staff included the following: H. P. McCue, of Pittsburgh, Pa., Assistant Fuel Controller for Canada in the United States, with D. H. Connor as his assistant; David S. Kerr, C.A., of Montreal, as Fuel Control auditor; Joseph G. S. Hudson of the Mines Branch of the Department of Mines, as technical adviser; and F. G. McAlister, of Toronto, as statistician. Valuable assistance was given by H. V. Cann, Assistant General Manager of the Bank of Ottawa, who acted in an advisory capacity with respect to the cost investigation and price fixing programme. John Murphy, Electrical

Engineer of the Department of Railways and Canals and of the Railway Commission was good enough to give his services in connection with the conservation of fuel through the restriction of its use where electrical energy was available, and his efforts met with considerable success.

III. SOURCES OF SUPPLY.

(A) FOREIGN IMPORTATIONS.

One of the outstanding aims in the policy of the Canadian Fuel Control ever since its organization has, of necessity, been to arrange for the movement of the requisite tonnage of coal imported into this country. Our bituminous requirements were a more or less indeterminate quantity owing to the increasing activities of the country's war industries; and furthermore the question of the supply of imported anthracite was acute, the situation as it turned out being intensified by the winter of 1917-18, which in severity had not been equalled in the previous twenty years. The figures in net tons presented in the following table indicate the extent to which importations have been necessary to make good the deficit between the consumption and production of coal in Canada:—

Calendar Years.	Imports.		Production less exports.	Consumption.
	Anthracite.	Bituminous.		
1913	4,642,057	13,559,896	13,383,592	31,585,545
1914	4,435,010	10,286,047	12,131,266	26,852,323
1915	4,072,030	9,046,331	11,440,790	24,559,151
1916	4,574,214	13,289,830	12,285,253	30,149,297
1917	5,220,688	17,219,824	12,266,275	34,706,787
1918	4,782,568	17,274,486	13,040,270	35,097,324

Conditions in the United States

Prior to the war, ample supplies of United States coal had been available, and the American operators were able to send tonnages to Canada as and when required. The abnormal situation created by the war changed this state of affairs, and at the time of the appointment of a Fuel Controller in June, 1917, it was evident that the situation in the United States had been completely reversed, and that the sudden expansion of war industries in that country was causing a rapid increase in their own requirements. Canada was at that time, therefore, confronted with the fact that the demand for United States coal greatly exceeded the supply. In addition, the network of railways over which coal for Canada had to be moved was becoming badly congested. No one could tell when the war would cease; no one could forecast the severity of the coming winter, and, while the great struggle continued, no one could give the Fuel Controller any guarantee against interruption to mining operations or a breakdown in transportation, both of which contingencies were not only possible, but highly probable.

Appointment of a United States Representative

In the face of a situation which held so many of the potentialities of disaster, it was early decided to appoint a representative in the United States, whose qualifications would enable him properly to safeguard Canada's interests. Such a man not only had to have a thorough working knowledge of American mining conditions, but would also necessarily have to be intimately conversant with the intricacies of United

States rail and water transportation systems. For this work, the Fuel Controller was finally able to secure the services of H. P. McCue, of Pittsburg, at that time General Manager of Transportation for the largest producing coal company in America, and a Vice-President of one of the coal-carrying railroads in the Pittsburg district. In July, 1917, Mr. McCue organized a small staff and opened up an office in Pittsburg in the heart of the coal-producing district, and, with his wide personal acquaintance among coal operators and railroad officials, he rendered invaluable assistance in facilitating the movement of coal to this country. The two factors which contributed most towards reducing the inefficiency under which the transportation systems had been labouring were the establishment of the Ore and Coal Exchange at Lake Erie ports, and the inauguration of the coal zoning system, in both of which Mr. McCue played an active part.

Immediately following his appointment, the Fuel Controller visited Washington and took up with Frank S. Peabody, Chairman of the Coal-producing Committee of the National Defence Organization, the question of Canadian supplies. He now wishes to express his warm appreciation of the fair and liberal treatment accorded him during the short period he had to deal with Mr. Peabody. That same generous treatment was continued by Dr. Harry A. Garfield, who accepted office as United States Fuel Administrator in August, 1917. In that year the situation was becoming increasingly acute as the autumn advanced, and in November Dr. Garfield concluded to allot tonnages to Canada quarterly, issuing permits to shippers for definite amounts making up the total allotments.

System of Coal Allotments

In the early spring of 1918, one hundred million people in the United States had made marvellous strides in war activities, and the coal situation looked so disturbing, that Dr. Garfield decided to allocate between the different states and provinces the available supplies. Among the principles underlying the system of allotment as adopted, was the elimination of unnecessary car mileage by compelling each consuming area to look to the nearest mining district for its fuel. The increase or decrease of population in the consuming centres was also taken into consideration. With respect to anthracite, this had the effect of largely limiting consumption to territory within a more or less restricted area radiating from the producing centre in Eastern Pennsylvania. In a series of conferences with the members of the United States Fuel Administration, the Fuel Controller based Canada's claims on the fact, that American coal operators in the past had actively canvassed, and secured the Canadian market, and had, therefore, clearly obligated themselves to continue to supply it. The United States Fuel Administration freely accepted this view and gave assurance to the effect, that Canada would be given every opportunity to secure tonnage on the same basis as was extended to American territory similarly situated.

Canada's Share

In calculating the allotment for the year ending March 31, 1919, the United States Fuel Administration adopted the coal year ending March 31, 1917, as a basis for Anthracite supplies, in view of the fact that the intervening year had been abnormal—the coldest in many years. The tonnage finally alloted to Canada was about 1,000,000 tons less than was consumed during the previous extremely cold winter. Various causes had arisen necessitating this step, as, for instance, the numerous war activities of the United States; the pressure brought to bear by states that had suffered not only severely, but with actual loss of life in some communities during the previous winter, on account of a shortage of anthracite; and also it must be admitted, too much talking by a few of our own people, who underestimated the gravity of the situation. A formal protest was entered

by the Fuel Controller against this reduction, in which it was pointed out, that the central consuming areas in Canada had, as well as the Eastern United States, experienced an expansion of population due to war industries. As a result certain further concessions were made to Canada. It was agreed not to charge this country's allotment with shipments of the smaller sizes of anthracite; and the allotment of bituminous coal to Canada was increased by 1,200,000 tons for domestic purposes. It was indeed a strenuous time for the various fuel organizations of both countries, but through it all the most harmonious relations existed between the respective administrations, due to the very fair and generous reception of our representations by Dr. Garfield and his able and courteous assistants. For industrial purposes, Canada was allotted 16,300,000 tons of bituminous coal for the year ending March 31, 1919, which with the 1,200,000 tons to make good shortage in anthracite, gave us a total of 17,500,000 tons.

The following tables are interesting as showing the details of tonnages of anthracite and bituminous coal which were to be moved into Canada as arranged in advance by the administrations of both countries:—

DETAILS of the Allotment of Anthracite Coal in gross tons for the coal year ending March 31, 1919—to Canada and Contiguous American territory, as determined by the United States Fuel Administrator in May, 1918.

Territory.	Distribution 1916-17.	Allotment 1918-19.	Percentage.	
			Increase.	Decrease.
New England States	9,833,379	10,331,000	16.95	
Atlantic States	27,878,233	31,417,154	12.69	
Central States	5,100,124	3,481,945		31.75
Northwestern States	2,710,188	2,380,000		12.18
Canada	4,081,600	3,602,000		11.76

NOTE.—United States Fuel Administration figures are supposed to exclude all grades below pea (i.e. all buckwheat and rice sizes). There has always been a divergence between the export figures of the United States and the import figures of Canada. It is generally believed that import figures are more reliable. There is of necessity some difference, as for instance, coal which appears as exported from the United States in the last week of one month will appear as having been imported into Canada in the following month, and sometimes even later.

DETAILS OF ALLOTMENT OF ANTHRACITE COAL, IN GROSS TONS, FOR THE YEAR ENDING 31ST OF MARCH, 1919, TO THE CANADIAN PROVINCES.

Canadian Territory.	Distribution 1916-17. (a)	Allotment 1918-19. (b)
Maritime Provinces	189,060	146,000
Ontario	2,309,602	2,153,327
Quebec	1,117,218	1,001,000
Head of Lakes & West	465,720	286,327
Unallotted		15,346
Total	4,081,600	3,602,000

(*a*) The Canadian Customs, at the request of the Fuel Controller, commencing April 1, 1918, showed anthracite reports in two classes, namely pea and larger varieties in one class and smaller sizes in the other. Previous to that date there was no distinction, hence the figures in this column include both classes.

(*b*) This column shows the total amount of anthracite allotted by the United States Fuel Administration to Canada. The Fuel Controller had allotted 3,586,654 tons up to December 31, 1918, and the balance would have been divided between Ontario and Quebec (largely to the latter) had not all restrictions on exports to Canada been removed early in the present year.

DETAILS OF BITUMINOUS IMPORTS INTO CANADA, COAL YEAR ENDING MARCH 31, 1919 (IN NET TONS).

Month.	Allotment.				Actual Shipments—1918-19.				Actual Shipments.
	Lakes.	Ferry.	Rail.	Total.	Lakes.	Ferry.	Rail.	Total.	1917-18.
1918.									
April	188,000	178,100	524,750	890,850	171,911	185,413	540,116	897,440	873,843
May	851,000	178,100	524,750	1,553,850	742,470	185,686	509,221	1,437,377	1,215,891
June	981,000	178,100	524,750	1,683,850	871,408	170,186	794,014	1,835,608	1,655,417
July	1,536,000	178,100	524,750	2,238,850	1,049,186	181,070	855,866	2,086,122	1,901,425
August	1,536,000	178,100	524,750	2,238,850	1,132,463	167,705	816,269	2,116,437	2,213,353
September	1,574,300	178,100	567,650	2,320,050	1,077,164	148,303	718,212	1,943,679	2,192,415
October	1,574,300	178,200	567,600	2,320,100	861,197	141,019	801,327	1,803,543	2,178,440
November	959,400	178,200	567,600	1,705,200	514,813	121,060	987,161	1,623,034	1,645,146
December	.....	178,000	567,600	745,600	5,188	140,002	1,059,775	1,204,975	1,128,976
1919.									
January	.....	.....	567,600	567,600	.....	144,685	833,092	977,777	797,157
February	.....	.....	567,600	567,600	.....	73,724	647,191	720,915	506,647
March	.....	.....	567,600	567,600	.....	52,319	561,098	613,417	1,002,467
Total	9,200,000	1,603,000	6,597,000	17,400,000	6,425,800	1,711,182	9,123,342	17,260,324	17,331,177

Promoting Shipments

The securing of an allotment for Canada was, after all, only the initial step in getting the coal into the country. It was only through the continued co-operation of all governmental and trade agencies that a serious shortage was from time to time averted. Owing to the frequency with which emergencies continued to arise the United States naturally found it necessary to make, often suddenly, corresponding changes in their policy, and, as the stringency developed, they extended their control over the widespread agencies of production and distribution, continuing, as time went on, to tighten their grasp on the details of the situation. For instance, all coal for export moved only subject to special export licenses. Local fuel distributers were appointed for each mining district in that country, with full authority and instructions to keep the United States war industries and transportation systems supplied at all costs.

As far as Canadian industrial consumers were concerned, this had the effect, in numerous cases, of cutting off their established source of supply, and, as the United States Fuel Administration had tremendous obligations in looking after their own people, the needs of Canadian consumers were taken care of through our Pittsburg office. In a general way in fact, this office acted as trade bureau for the purpose of placing Canadian purchasers in touch with possible sources of supply.

The enormous demands made upon the transportation systems and terminals in the United States after that country's entrance into the war, and

with these systems in none too good a condition to meet those demands through intra and inter state legislative restrictions enforced for some years, the United States Government felt that it was necessary to take over their operation, in order to prevent further demoralization.

This action was closely followed by the famous "Shut-Down Order", which was intended to afford an opportunity for clearing-up the railway lines, and also for the coal operators to catch up, to some extent, with the supply for emergency points. During all this period of disorganization the Canadian trade was much disturbed by numerous embargoes, and rumors of embargoes, which all tended to interrupt the even flow of coal to Canada. Many of these embargoes were lifted or modified through the energetic efforts of our United States representative, who also was instrumental in having slow or lost shipments traced, and confiscation of consignments adjusted.

(B) Domestic Production.

There are in Canada three main coal-producing areas—in the east, the fields of Nova Scotia and New Brunswick; in the west, those of Alberta and Saskatchewan; while on the Pacific coast there are those of British Columbia, including the important fields on Vancouver Island. Both Nova Scotia and British Columbia have old and well-established Departments of Mines under Ministers responsible to the Crown, and, as the revenue of both Provinces are to a considerable extent obtained from their own coal lands, it was safe to assume that the Provincial Governments would use every effort to stimulate production. In New Brunswick also where the tonnage extracted is very small, the coal lands are the property of the Province, which likewise depends upon its coal production as a source of revenue. Its production showed a substantial increase, as did also that of Saskatchewan, another minor producer. The Alberta field was being operated under a Director of Coal Operations referred to elsewhere and who has been extremely successful in increasing production.

Maritime Fields

The situation in the Maritime Provinces dependent upon the mines in Nova Scotia, as the winter of 1917-18 advanced, became quite acute, notwithstanding the efforts of the Provincial Department of Mines. The general problem was to insure that the domestic needs of these provinces were met and their industries kept busy. Each province, however, presented conditions peculiar to itself, which demanded special attention, and in this work the provincial administrations concerned rendered splendid services. The following table shows the production of coal in Canada since 1910:—

PRODUCTION FIGURES (NET TONS).

Province.	1910	1911	1912	1913	1914	1915	1916	1917	1918
Nova Scotia	6,431,142	7,004,420	7,783,888	7,980,073	7,370,924	7,463,370	6,912,140	6,327,091	5,852,802
New Brunswick	55,455	55,781	44,780	70,311	98,049	127,391	143,540	189,095	267,746
Saskatchewan	181,156	206,779	225,342	212,897	232,299	240,107	281,300	355,455	345,310
Alberta	2,894,469	1,511,036	3,240,577	4,014,755	3,683,015	3,360,818	4,559,054	4,736,368	5,941,864
British Columbia	3,330,745	2,542,532	3,208,997	2,714,420	2,239,799	2,065,613	2,584,061	2,433,888	2,568,591
Yukon	16,185	2,840	9,245	19,722	13,443	9,724	3,300	4,872	2,900
Total	12,909,152	11,323,388	14,512,829	15,012,178	13,637,529	13,267,023	14,483,395	14,046,759	14,979,213

Promoting Production in Nova Scotia

The problem of endeavouring to maintain production was more difficult in the Nova Scotia fields than in any other mining district in Canada. Owing to the increased activity of the steel plants, and a growing demand for bunkering fuel, the requirements of the Province itself increased from 2,900,000 in 1913 to 3,225,000 tons in 1917, while the production fell off, due mainly to labour shortage, from about 8,000,000 to 6,500,000 tons. On the other hand, the consuming public, in the face of these conditions, had the right to expect the stabilization of prices to a point which would at once be equitable to operator and consumer. It was found impossible to classify these mines into groups according to the production costs, as was being done in the United States, and, accordingly, a survey of the most important mines was made by Mr. Kerr, and the price of coal at each mine was fixed on the basis of actual cost of mining coal therein, as ascertained by him.

Certain technical questions arose in connection with the operation of the Maritime Province mines, involving among other things a wide variation in the cost of production, and in this connection the Fuel Controller is deeply indebted to two leading men engaged in the coal industry of the United States, namely, F. S. Peabody of the Peabody Coal Company of Chicago, one of the large producing corporations, and S. A. Taylor of Pittsburg, a leading consulting mining engineer and operator, who acted as technical advisor to Dr. Garfield. Both gentlemen very generously gave their valuable time and services to the Fuel Controller, and accompanied him to the Maritime Provinces, in June last. Mr. Peabody had with him W. H. Leland, Vice-President of the Peabody Coal Company, as well as M. Peltier, its consulting engineer, and L. A. O. Gabany, the geologist.

As a means of increasing production, Mr. Taylor recommended that the Nova Scotia Steel and Coal Company should be permitted to break into certain adjoining leases controlled by the Dominion Coal Company.

Representations were accordingly made both companies, looking to an arrangement that would make possible the carrying out of Mr. Taylor's recommendations. No understanding having been reached at that time, the Fuel Controller upon his appointment as Director of Coal Mining Operations in the Maritime Provinces again took the matter up, but the signing of the armistice and continued mild winter weather obviated the necessity of further action on his part, and the matter was allowed to drop.

Appointment of the Fuel Controller as Director of Coal Operations

With the growing cost of living during the war period, it was inevitable that demands for increased wages would be made upon the operators. In the winter of 1917-18 the wage scale was revised upwards. A few days after the appointment of the Fuel Controller as Director of Coal Mining Operations, in September, 1918, a strike occurred in Pictou County affecting some two thousand miners. He immediately took the matter up with both interests on the ground, resulting in the creation of a committee to investigate the cost of living, which was composed of members of the Federation of Labour and representatives of the Coal Operators, with Charles W. Bolton of the Department of Labour as Chairman. The men at once returned to work. The result of the investigation, announced several weeks later, was, that the miners were apparently entitled to an advance of 27 cents per day as from the first of September, whereas the operators had only offered them 20 cents per day. Following this, J. C. Watters was appointed as the representative of the Director of Coal Mining Operations in the Maritime Provinces. His functions were to act as an intermediary between the operators and the employees, to establish small committees in each mining district, on

which both interests would be represented, thereby obtaining the fullest co-operation in maintaining production, and having available such agencies for the prompt adjustment of any differences that might arise from time to time. Mr. Watters did excellent service and retired on January 31st, 1919.

The order-in-council appointing the Director of Coal Mining Operations provided, that these duties were to continue during the war and for three months thereafter. As hostilities ended on the 11th of November, 1918, the office of the Director of Coal Mining Operations automatically ceased to exist on the 11th February, 1919. In announcing this fact to the interested parties in the Maritime Provinces, they were also given to understand that no further control of prices at the mines would be exercised by the Fuel Controller either in the Maritime Provinces, or elsewhere in the producing areas of Canada.

Western Fields

In Alberta and eastern British Columbia, differences between operators and employees in the mines, in what is known as District No. 18 of the United Mine Workers of America, had arisen some time previous to the creation of the Fuel Controller's organization, and the Government had already appointed W. H. Armstrong as Director of Coal Operations in that District. Mr. Armstrong's authority included the adjustment of wages and the fixing of prices of coal at the mines. The table on page 20 shows the marked increase in production in Alberta under Mr. Armstrong's management since his appointment early in 1917.

One of the chief difficulties in the Western situation lies in the fact that the demand is not sustained throughout the summer season. In addition, the enormous coal reserves of Alberta alone amounting, it has been estimated, to approximately 15 per cent of the entire world's supply, together with its easy accessibility, has led to the opening-up of mines in such numbers that the average annual production of each runs in the neighbourhood of 20,000 tons. Accordingly, in spite of keen competition, the costs of production are relatively high.

British Columbia too has had its mining troubles. It has experienced very great difficulty in maintaining production, due to a shortage of labour. In this field, particularly on Vancouver Island, coal prices had to be adjusted from time to time, in conformity with changing conditions of labour. These adjustments were based on mine audits either made on the ground by the Fuel Control Auditor or under his direction.

After prices were once fixed in any field, outside of District No. 18, controlled by Mr. Armstrong, applications for increases had to be made to the Fuel Controller, who was kept in touch with changing conditions at the individual mine by the return of monthly forms covering output, labour and costs, which were systematically revised by the Cost Investigation Branch at Ottawa. As occasion demanded also, supplementary investigations as designated were made in person from time to time by special technical representatives. The Fuel Control Auditor also investigated costs in District No. 18, at the request of and under the supervision of Mr. Armstrong.

IV. DISTRIBUTION.

(a) Canada's War Coal Budget.

In attempting to supervise the distribution of fuel throughout the country during a critical period such as that from which we have just emerged, the general public has been inclined to expect too much from an organization suddenly brought into existence, and called upon, as the Canadian Fuel Control was, to look after the needs of a comparatively small population scattered over an immense area from the Atlantic to the Pacific. Restrictions in the use of food for a few months might result in considerable inconvenience, but not in any particular bodily harm. Any serious shortage of fuel in Canada in mid-winter, however, would be most disastrous.

The main factor in the distribution of coal in any country is, of course, that of transportation; and nowhere else on the continent of America have the railroad systems such difficult operating conditions to contend against as have those of Canada during the winter season. Those responsible for the operation of Canadian railways have every reason to feel proud of what has been accomplished. During the great crisis, outside of the Niagara congested section (Buffalo to Hamilton), it can hardly be said, that at any time were the country's transportation systems unable to cope with the vast volume of business that was being transacted. Our waterways also, on which 42 per cent of the total coal imported comes into Canada, are open for only about seven months in the year, during which period the demand for coal is at its low ebb. To give some idea of the receipts and distribution of coal tonnages in Canada, the following table for the year 1917 has been prepared from the available information that it was possible to bring together. It should be borne in mind that it is only an approximation, and is given more for the purpose of suggesting that information of the character shown therein should be prepared annually by some branch of the Government service.

CANADA'S COAL TRADE BALANCE SHEET.

—	N.S.	N.B.	P.E.I.	Que.	Ont. Central.	Head of Lakes and Manitoba.	Sask.	Alta.	B.C. and Yukon.	Grand Total.
Imports	26,326	21,904	.....	4,084,255	10,261,637	2,803,154	745	749	21,054	17,219,824
Mine output	6,345,335	189,668	.....	.....	.....	.....	360,623	4,744,697*a*	2,682,024	14,322,347
Received from other Provinces	.....	994,741	115,548	366,256*b*	500,000*c*	249,549	1,140,487	.....	72,833	3,439,414
Total tonnage made available	6,371,661	1,206,313	115,548	4,450,511	10,761,637	3,052,703	1,501,855	4,745,446	2,775,911	34,981,585
Shipped to other Provinces	1,455,431	200,396	.....	500,000*c*	.....	6,350	.....	1,356,519	.....	3,518,696
Exports	676,281	26,543	.....	49,358*g*	252	.....	.....	92,810	887,912	1,733,156
Net balance available	4,239,949	979,374	115,548	3,901,153	10,761,385	3,046,353	1,501,855	3,296,117	1,887,999	29,729,733
Consumed by railways	1,034,827	26,057	16,951	551,533	5,962,383	2,131,725	5,048*d*	1,383,216	680,810	11,792,550
Consumption by Leading industries — U.S. coal	9,654	66	9	1,634,984	2,831,298	76,508	2,793	324	1,068	4,556,704
Consumption by Leading industries — Can. coal	1,085,686	222,738	5,292	319,221	.....	81,963	167,275	66,067	138,499	2,086,741
Domestic Consumption (*e*)	569,972	628.059	93,096	1,376,060	1,083,235	515,176	1,016,088	1,032,991	504,381	6,819,058
Used in making coke	306,374	.....	.....	.....	549,985	.....	3,000	102,609	278,590	1,240,558
Colliery consumption	727,602	4,414	.....	.....	.....	.....	17,820	312,190	21,746	1,083,772
Bunker	428,929	.....	.....	.....	.....	.....	.....	.....	.....	428,929
Known losses in mining	16,371	60	.....	.....	.....	.....	5,178	142,628	232,125	396,362
Used in making gas for lighting and heating	.....	.....	.....	3,076	270,937	2,313	.....	.....	13,902	290,228
Used for electric light and power plants — Canadian	60,534	23,477	200	100	791	2,234	68,044	143,368	16,878	315,626
Used for electric light and power plants — U.S. Coal	.....	.....	.....	16,179	62,756	24,084	358	.....	.....	103,377
Gain during year in tonnage on wheels, in stock and otherwise unaccounted for	.....	74,503	.....	.....	.....	212,350	216,251	112,724	.....	615,828
Total disposition	4,239,949	979,374	115,548	3,901,153	10,761,385	3,046,353	1,501,855	3,296,117	1,887,999	29,729,733
Anthracite imported and consumed	71,263	100.555	5,147	1,664,095	2,963,940	443,016	71,514*f*	.....	149	5,319,679
Alberta Anthracite	.....	.....	.....	.....	.....	323	5,634	21,693	3,564	31,214
Total anthracite	71,263	100,555	5,147	1,664,095	2,963,940	443,339	77,148	21,693	3,713	5,350,893
Grand total (Bituminous, Lignite and Anthracite)	4,376,087	1,093,100	120,695	5,614,606	13,725,325	3,489,692	1,579,003	3,320,381	1,891,700	35,210,589

(*a*) Of which 2,537,829 tons are Lignite. (*b*) Mines Branch figure plus "Coal Trade of Canada" figure for N.B. (*c*) Estimated as shipped into Ontario from Quebec. (*d*) Railroad Tonnage in Saskatchewan included in Alberta. (*e*) Estimated with reference to anthracite and wood also burned. (*f*) Commercial coal. Rail, fiscal year ending March 31st. (*g*) This tonnage is unallocated, and placed under Quebec for convenience.

Supplies for Domestic Use.

Maritime Provinces

The problem of anthracite supplies for the Maritime Provinces was, as elsewhere, mainly a question of transportion. The large proportion of hard coal consumed in these provinces moves by water from New York. Enemy submarine activities, coupled with an increased demand for vessel tonnage for the purpose of transporting troops and supplies to Europe, led to a decrease of the available supply of bottoms for the Atlantic coast trade. Rates on coal from New York to the Maritime ports had risen from a pre-war level of $1.25 per ton to $7 and over in 1918, which was considerably higher than corresponding rates in the United States. To make the situation more complicated, the shortage of coal made it almost impossible to secure a cargo even when boats were available. In the summer of 1918 the prospect was so unpromising, that the Fuel Controller deemed it advisable to publicly counsel eastern consumers to get in supplies from the mines in their own provinces, while he continued to press upon the United States Fuel Administration the seriousness of the situation. Finally a special representative from the Fuel Control office in Pittsburgh was stationed in New York to co-operate with the United States Fuel Administration, the anthracite dealers, and the ship brokers, in order to straighten out the tangles which were preventing the movement of this coal. Excellent results were being obtained, when the signing of the armistice, combined with the extraordinarily mild winter, made further efforts unnecessary, the supplies of anthracite soon proving sufficient to meet all the requirements of the Maritime Provinces.

Central Canada

The provinces of Ontario and Quebec were naturally entitled to a major share of the available anthracite, not only because of their greater population, but also by reason of their dependence on this class of fuel. To the province of Onatrio early last year there was assigned 2,153,327 gross tons, on the basis of the amount of coal this province had consumed during the year ending March 31, 1917. The Provincial Administration in turn subdivided this allotment, on a similar basis, to the various municipalities throughout the province. Aside from a limited tonnage which crosses lake Ontario and the St. Lawrence river, a large percentage of the anthracite consumed by the province of Ontario enters Canada through the Niagara gateway, as well as a proportional tonnage of bituminous, the facilities at this point consisting of but two railroad bridges, which during the winter season, are invariably congested. This congestion was greatly magnified, owing to the exceptional severity of weather conditions prevailing throughtout the winter of 1917-18, and constituted one of the main difficulties of Fuel Control at that time.

The tonnage allotted to the province of Quebec in the present coal year, 1918–19, was 1,001,000 gross tons. Mr. Marler, upon accepting office as Fuel Administrator last summer, quickly made a complete survey of the coal requirements of the province, which enabled him to follow and control the distribution throughout his territory from month to month.

Considerable quantities of coal for this province are brought in by water, the port of Montreal offering exceptional facilities for such purposes. One of the large railway companies producing anthracite coal also has a direct rail connection with that city, resulting in it largely being the distributing point for the province.

Prairie Provinces

Second only in importance to the heating problem of Central Canada, which, as has been stated, depends so largely on the United States for its fuel, is the situation in the prairie provinces. Manitoba had received in the past a considerable tonnage of Pennsylvania anthracite, which was brought up the lakes to Port Arthur and Fort William, there to be stored and drawn upon as required.

The western lignite operators early in 1918 reached the conclusion that they could take care of the Western needs, which in recent years involved about 2,000,000 tons of imported bituminous as well as from 400,000 to 500,000 tons of anthracite, for use from Lake Superior westward. The proposal of these operators was that the imported anthracite and bituminous should be replaced by Western Canada coals.

A convention was held in Ottawa on the 17th April, 1918, and a difference of opinion arose between the lignite producers, on the one hand, and the consumers in Winnipeg and adjacent territory, on the other. The representatives of the latter claimed that much suffering would result if their normal quantities of anthracite were not made available. In support of this contention, they urged that there were no storage facilities in Winnipeg for coal, as that city ordinarily depended on stocks of coal stored at the head of the lakes. They alleged further that the people themselves had not the proper equipment for burning soft coal. At the meeting there was present a representative of the United States Fuel Administration, who ultimately announced that the policy of his administration would be to meet fully the anthracite needs of the territory east of Buffalo, while the territory west thereof would have to look to some considerable extent to local fuels, and that the same policy would apply to Canada. Western Canada, in consequence, was placed on practically a fifty percentage basis of its normal supplies of anthracite. The representatives of the railways at the convention urged that every effort be put forth to get the people to take in stocks during the summer. At that time a very heavy harvest in the west was anticipated and, with the increased demands that would then be made on the transcontinental lines, their officials were clearly concerned about being able to look after the distribution of coal unless the lignites were largely moved during the summer. Respecting the increased production of bituminous in the west, the railways stated that with the growing war activities of the country their business would demand all that could be produced.

Finally, in view of the seriousness of the situation, the Fuel Controller went west, and, at a public meeting in Winnipeg on May 14, 1918, announced that householders would be obliged to stock up with lignites to at least 50 per cent of their normal requirements before they would be allowed to purchase any anthracite. While it was regrettable to have to take such drastic action, which undoubtedly caused some resentment at the time, it was nevertheless absolutely unavoidable in the event of the war continuing throughout the winter; and also assuming that that season should be in keeping with Manitoba weather traditions. Another matter that resulted in considerable public comment in Winnipeg was the action of one of the large anthracite shipping companies, which moved aside the usual importing channels of its product and shipped same through an entirely new agency. There seemed to be no sound reason for such action, involving as it did, an extra commission. It likewise was done by shippers of soft coal, in certain instances into central Canada, and was not prohibited under the Coal Regulations, nor could it be prohibited unless the Government was prepared to guarantee the purchase price of the coal to the shipping company.

Subsequently a plan of distribution of the available anthracite supplies was worked out by the Deputy Fuel Controller, in co-operation with the various Western Provincial Administrators and the coal dealers, who assigned to Winnipeg 65 per cent of its normal requirements, and to the remainder of the Province of Manitoba and the eastern part of Saskatchewan less than 50 per cent of their anthracite consumption of the previous year. By early autumn it had

become evident that a sufficient supply of coal of all sorts had been distributed in the west, reasonably to guarantee that this section of the country would be carried through the winter without trouble.

British Columbia

The climate of western British Columbia, in which area the large percentage of the population is centered, is less severe in winter than in any other locality in Canada. This, together with the proximity of coal and a plentiful wood supply served to reduce their fuel problem to a minimum.

(B) Provincial and Municipal Organization.

In accordance with the general policy already indicated, the Premiers of the respective provinces were asked in the early summer of 1917 to nominate representatives who would co-operate with the Fuel Controller in carrying out the various phases of fuel control. The following gentlemen (honorary representatives of the fuel controller in their respective provinces) continued in office until conditions made it imperative, as the war advanced, for a more complete organization extending down into each municipality:—

J. A. Macdonald for Prince Edward Island.
Hon. R. G. Beazley for Nova Scotia.
Dr. James H. Frink for New Brunswick.
Hon. Alphonse Racine for Quebec.
R. C. Harris for Ontario.
George W. Allan, K.C., for Manitoba.
J. B. Musselman for Saskatchewan.
John T. Stirling for Alberta.
Nichol Thompson for British Columbia.

Mr. Allan retired when elected to the House of Commons for South Winnipeg. With the creation of provincial and municipal machinery under the amended regulations effective April 1, 1918, the following gentlemen were appointed by their respective Provincial Governments as Fuel Administrators, namely:—

J. A. Macdonald for Prince Edward Island.
R. H. MacKay for Nova Scotia.
Dr. James H. Frink for New Brunswick.
Hon. Alphonse Racine for Quebec.
R. C. Harris for Ontario.
Thos. R. Deacon for Manitoba.
T. M. Molloy for Saskatchewan.
John T. Stirling for Alberta.
Nichol Thompson for British Columbia.

Subsequently, certain changes were made in this personnel, so that at the present writing, H. M. Marler holds the office in Quebec (having succeeded the late Mr. Racine); R. Home Smith and his assistant, E. L. Cousins, in Ontario; and J. A. Macdonald in Manitoba. Space forbids extending the list to include the names of the vast number of municipal or local Fuel Commissioners scattered throughout the country.

The Provincial Fuel Administrators, with the organizations which they built up, assisted by the Fuel Commissioners, assumed the responsibility of the distribution of the tonnages allotted to their respective provinces. Acting in close co-operation with the federal organization, they have also been instrumental in controlling prices. Another important feature of their work consisted in the development of a demand for coal substitutes such as wood and coke, as well as

encouraging, wherever possible, the use of bituminous coal in place of anthracite for domestic purposes. In those provinces in which coal deposits occur, it was the additional duty of the Fuel Administrators to stimulate production. In general, the Administrators throughout the Dominion were charged not only with the responsibility of acting as advisors to the Fuel Controller in all matters pertaining to the fuel supply of their respective provinces, but also to enforce his regulations, as they were promulgated from time to time. Whatever measure of success may be attributed to the Fuel Control organization, it should be largely ascribed to the loyal support and co-operation of all those outside officers connected with the work, and especially to that of the Provincial Fuel Administrators.

In addition to the provincial organizations, which were financed by the provinces, the coal regulations called for the appointment of local Fuel Commissioners in each municipality, who were to be appointed by the municipal authorities concerned, and the expense incurred was to be borne by them. Speaking broadly, the task of these commissioners was to develop team work among the various dealers in their municipality, and, in periods of coal stringency, to prevent panic among consumers. To this end they were empowered, when necessity demanded, to pool the stocks of all dealers, and ration consumers, generally basing their action upon a daily report system by the dealers as well as a card index system of deliveries to consumers. In short, the fuel commissioner's office became a clearing-house for the municipality's coal requirements. Dealers' delivery equipment was fully mobilized, and the possibility of duplicate orders being placed by over-anxious consumers was eliminated. In many cases, municipalities made arrangements to supplement the threatened shortage of coal by encouraging, directly or indirectly, the cutting and stocking of wood.

(c) Price Control.

In September, 1917, the Fuel Controller issued, through the press a warning to coal dealers as to methods they should pursue, and then made the following statement:—

> "My policy as Fuel Controller has been to interfere as little as possible with the business of the coal dealers, beyond encouraging them in every way possible to get in a sufficient quantity of coal to meet the needs of their particular localities. I am confident that most of them are as fully alive as the rest of us to the duty of mutual helpfulness in these abnormal times, and have no thought of charging prices that will yield more than a fair profit.
>
> "I wish to appeal, however, particularly to the dealers in our towns and cities, where large quantities of coal are handled in small lots, to deal in a generous manner with the small users of coal, and add as little as possible to the heavy burdens they are now carrying.
>
> "I expect our fuel dealers to put me in a position—without my having to force the issue—to say to the public, after this abnormal situation passes away, that no section of our business organization met their responsibilities in a more generous and patriotic spirit than those engaged in looking after their country's fuel supplies."

Impossibility of Fixing a Definite Selling Price

As might be anticipated from the nature of the situation, the price of coal showed an upward tendency during the period of the war. This was due principally to increases in the cost of labour and materials, higher freight rates, and general overhead expenses. In many instances reduced output due to enlistments also accounted for part of the increased costs. Moreover, it was impossible to fix a definite price to con-

sumers on either anthracite or bituminous coal, owing in the first place to the wide variation in the prices at the mines, whether American or Canadian; secondly, to the many different routes over which this coal might be moved, whether by rail or water; thirdly, to the variety of trade channels it might follow; and, lastly, to the widely varying conditions in different localities with respect to handling and delivery. The principle finally adopted in regulating prices was that of allowing to dealers a reasonable profit above the actual cost of the coal together with handling, overhead expenses and fixed charges. The amount set as a limit to this profit being, in the case of wholesalers, 35 cents per net ton, and in the case of retailers, 50 cents per net ton. Brokers, on the other hand, were allowed a straight commission charge of 30 cents per net ton, out of which all overhead and other expenses were to be defrayed. As previously indicated the operators' prices were fixed at the mines.

Investigation subsequently made led the Fuel Controller to believe that dealers throughout the country were figuring from widely-divergent premises, with respect to their costs of operation. In order, therefore, more clearly to define the basis on which such calculations were to be made, an amendment to the regulations was found necessary, indicating those items which would be regarded as legitimate, and giving specific rulings on what could, or could not, be included under the heading of "handling," "overhead" and "fixed" charges. Detailed information was thereafter called for monthly on standard forms, enabling the Cost Investigation Branch to assist dealers in establishing a fair and reasonable selling price. At a number of points it was found necessary to fix formally a "Maximum Gross Margin" to be used in arriving at dealer's selling prices, which gross margin was the difference between the price F.O.B. destination and the selling price to the ultimate consumer. The procedure in such instances was to have a special investigation made on the ground by a member of the Fuel Control organization.

Dealers' Profits

The consuming public naturally will expect some further statement as to the extent to which coal prices were controlled during the great crisis. When the Fuel Control was organized early in the summer of 1917, the public mind seems to have been obsessed with the notion that enormous profits were being obtained by the trade. There seemed to be an idea abroad that profits were exorbitant and measured not by cents but by dollars. It would be idle to suggest that injustices have not occurred. But the investigations made did not disclose any over charges that could be termed profiteering. More than that, it would be manifestly impossible to administer such regulations without occasional infractions, unless a coast to coast organization had been in readiness the moment the demand for coal exceeded the supply. However, in those localities where municipalities realized their responsibilities and, taking advantage of the coal regulations, elected energetic officials to act as Fuel Commissioners, the interests of the public were closely looked after. Generally speaking, those engaged in the coal trade had an extremely strenuous time, and their record will compare most favourably with those engaged in other lines of business. The dealers were forced to submit very complete monthly statements as to their supplies, costs and selling prices. The analysis of these statements resulted in a considerable number of cases having been submitted to the Provincial administrations to be run down by them through their Fuel Commissioners or their own offices. The outcome was that in many instances dealers were restrained in their ambition to advance prices. This work was accomplished without any publicity, and consequently was the more effective; because the people had to have coal and it was necessary that each dealer should throw all his energy into the work to get supplies. The best service was

needed from all, and that would not have been obtainable if the policy of the Fuel Controller had been to give publicity to this phase of the work, creating in the minds of the people the idea that this or that dealer was making exorbitant charges or profiteering.

Turning to the larger coal transactions, as for instance those of the big importing companies, some of them failed to supply information as to their activities. This, it was claimed, was due to the pressure of work, and depletion of office staffs. In addition the statement was made that some of the large importers of soft coal had been extracting profits of one dollar per ton and over. As this coal originated in the United States, the Fuel Controller secured for a short time the services of C. F. Napier, jr., of the staff of the Federal Trade Commission, Washington, D.C. A thorough examination was made of the books of some of these companies. It was found that in certain instances excess profits had been taken, varying from one to five cents per ton. Some of the importing companies have their own boats, usually owned by subsidiary companies. This was not a recent procedure but existed prior to the war in most cases. In the examinations that were made, such concerns were allowed to charge the freight rate in force by the regular shipping companies, over which rate the Fuel Controller had no authority.

To obtain the proper view point of any excess profits made by any dealer, it is necessary to look back at the situation which existed in the earlier period of the crisis. Conditions were changing from day to day and the trade had to make some effort to anticipate the future and protect itself. On the whole there is no doubt but that the public were protected from a considerable advance in coal prices in many parts of Canada, where, at times, the supply of coal was not at all assured and the buyers were most concerned about their needs.

With the explanations that have been made as to the situation which existed and the results obtained, the Fuel Controller feels confident that the public will conclude that the fuel situation was controlled; that the interests of the consumer with respect to retail prices were satisfactorily protected, and in a way which obtained the best results from the trade. An interesting series of charts appears in the appendices. An examination of them shows that the rise in price of anthracite in Canada, during the war period, was more than outstripped by the increased price of the majority of the other necessities of living.

Licensing of Coal Trade

In exercising efficient supervision of the distribution of coal, a license system was obviously a prime necessity. In the 1917 regulations it was provided that importers of coal must apply to the Fuel Controller for an importer's permit, and that any person engaged in the business of selling coal as a broker, wholesaler or retailer must apply for a dealer's permit. The regulations also provided for suspension or cancellation of such permits for any cause deemed sufficient by the Fuel Controller, and heavy penalties were also imposed in cases where unlicensed persons transacted a coal business.

From the first of April, 1918, the issuance of these permits was made subject to the payment of fees. Importers paid their fees to the Fuel Controller's office at Ottawa. Dealers' fees were payable to the Fuel Administrator for the province, who endorsed all applications for permits of this class prior to forwarding them to the central office for action. The revenue from importers' fees has been a very material contribution towards the cost of the headquarter's organization. The Governments of the various Provinces have, according to the regulations, utilized the fees from dealers' permits towards defraying expenses incurred in connection with the offices of the Fuel Administrators.

The total revenue to the Dominion Government, derived from coal importers' permit fees amounted to $55,953.40. The revenue accruing from dealers' permits to the respective Provinces was as follows:—

Province.	Revenue.
Prince Edward Island	$ 511 00
New Brunswick	1,191 00
Nova Scotia	1,803 00
Quebec	12,308 00
Ontario	26,010 00
Manitoba	5,864 00
Saskatchewan	7,334 00
Alberta	3,787 00
British Columbia	755 05
	$59,563 05

Expense of Organization

The Fuel Controller's organization is being disbanded at the end of the present month, March 31, 1919. The net cost of the organization, from its inception in June, 1917, to the conclusion of operations, will be in the neighbourhood of $114,000.

V. CONSUMPTION.

(A) Restrictions.

The "Shut-down Order— "Heatless Days"

Towards the close of the year 1917 a series of disasters occurred which all but paralyzed the already overburdened transportation system, and culminated in the most drastic and dramatic action taken in the United States by the Fuel Administration of that country during the course of the war. Following an enormously enlarged demand for coal on the part of war industries in the New England States, there had come to America the sudden call for increased tonnages for bunkering purposes, and this at a time when the continent was passing through a winter characterized by weather conditions of unparalleled severity. The outcome of all this was, that on January 17, 1918, the Fuel Administration issued an order calling for a complete shut down of all industry and business throughout the United States for five days. It became clear on the issuance of this order that, apart from the question of coal saving, such action by the United States authorities would make it incumbent upon Canada to do likewise.

The Canadian "Heatless Days" regulations were consequently authorized by order in council of February 5 (P.C. 298). The days fixed for the cessation of work were Saturday, February 9, Sunday, 10, and Monday, 11. The territory within which these regulations applied was circumscribed, so as to include only Central Canada, from Riviere du Loup to Fort William. Offices and stores were closed, as well as all plants not engaged in the manufacture of war supplies. In conformity with the action of the United States Fuel Administration, places of amusement in Canada, including theatres, moving-picture houses, bowling alleys, billiard rooms and dance halls, were closed on February 18 and 25, and the 4th of March. Originally six Mondays were specified as closing days, but the regulations were subsequently modified.

In the same regulations there was included a section prescribing the closing of golf, country, yacht, canoe and hunt clubs every day throughout February and March, except Wednesdays and Saturdays. These restrictions were removed on March 8, 1918. Further restrictions were placed on such clubs during

the succeeding winter in that from December 15 on, they were prohibited from burning coal, coke or fuel-oil except under special permission. A regulation was also approved in July, 1918, prohibiting the use of coal or fuel-oil on private yachts. The manner in which the public responded to these restrictions was particularly gratifying.

Conservation of Gasolene

An appeal to the people of Canada to exercise economy in the use of gasolene was issued on September 9, 1918. In the announcement on the subject it was explained that recent information disclosed the fact that production was beginning to lag behind the demand from all sources. The requirements of the Western harvest fields, owing to the ever-increasing use of mechanical motive power, had been very large, and the country was then face to face with an actual gasolene shortage. This was the period of the year when the consumption of gasolene was at its highest, and the increased domestic and agricultural demands, together with the extensive overseas requirements, rendered necessary adequate safeguards against a possible serious shortage.

Under the circumstances, the Fuel Controller appealed to the people of Canada to exercise the most rigid economy in the consumption of gasolene until such time as the public could be officially notified that no further necessity existed for extraordinary economy. This, it was stated, could be effected in two directions; first, by eliminating entirely all unnecessary use of motor cars; secondly, by the economical use and handling of gasolene.

The public was particularly requested to discontinue the use of motor-driven vehicles on Sundays with the following exceptions: Tractors and motor trucks employed on actual transportation of freight; vehicles of physicians used in performance of professional duties; ambulances, fire equipment, police wagons, undertakers' wagons and conveyances used for funerals; railway equipment using gasolene; repair outfits employed by telephone and public service companies; and motor vehicles on errands of necessity in rural communities where transportation by steam or electricity was not available.

In regard to economy in handling, it was estimated that strict observance of the following rules would conserve one and a half million gallons of gasolene daily in the United States, in Canada the saving being proportional; (1) avoid spilling gasolene; (2) don't permit leaks; (3) use no gasolene for washing; (4) do not leave tanks or cans open; (5) waste no lubricating oil.

This appeal for voluntary conservation of gasolene was popularly known as the "Gasless Sunday" campaign. Whilst some stress was placed on the discontinuance of the use of automobiles on Sundays, the appeal had a wider significance and aimed at the entire elimination of the unnecessary use of motor cars at any time.

However, after a little over a month the Fuel Controller was able to announce, on information received from the United States authorities, that supplies of gasolene had reached a point which justified the termination of gasless Sundays. On October 18, 1918, the ban on Sunday motoring was removed.

Conservation of Coal Gas

By order in council, March 20, 1918, it was enacted that "No purchaser or consumer of gas produced from coal within the Dominion of Canada shall use gas for advertising purposes or for ornamental lighting." This order was issued in sympathy with a similar order in regard to the use of electric power for the above mentioned purposes, which had been made by Sir Henry Drayton, Power Controller for Ontario. Conditions improved after the signing of the armistice, and in January, 1919, the restrictions on the use of coal gas were entirely removed.

Restrictions in Specified Industries

With a large proportion of industrial operations in Canada devoted to war activities, the question arose as to whether fuel restrictions should be applied to other industries not engaged directly in the production of war material. A general survey of the fuel consumption in this country was undertaken in order to ascertain to what extent fuel consumption might be curtailed in sympathy with the restrictive orders issued in the United States, in connection with these industries. It was evident that unless some move in this direction was made, supplies to industries of this type would be seriously curtailed by the United States Fuel Administration, regardless of whether or not they were engaged in the manufacture of war materials. A survey of the situation was made, in co-operation with the War Trade Board, and a series of conferences was held in Ottawa, during September, 1918, with representatives of the industries interested. Owing to the fact that this country had been on a war footing for some two and a half years prior to the entry of the United States into the war, it was found that production had already fallen off from 50 to 75 per cent, and that a large number of plants had either discontinued operation entirely, or were then devoting their equipment to the manufacture of war products. Distilleries, for example, were producing chemicals for use in the manufacture of explosives, and automobile plants were being used for production of trucks.

Conditions in the musical instrument industry were likewise investigated, and after a similar conference with the manufacturers a mutual agreement was reached whereby production was limited by an allotment of coal amounting to 70 per cent of their average annual consumption in pre-war times. Florists were also limited to a tonnage amounting to 75 per cent of their normal requirements.

Economies Effected by Railroads

The principal saving in fuel effected by the railroads was accomplished through a reduction in the number of passenger trains operated, and the general slowing up of schedules to a speed which permitted of a maximum efficiency for the coal consumed. They further co-operated by making use of old ties which had in the past been burned along the right of way, and in generally promoting conservation by cautioning their employees against overloading engine tenders, and preventing waste of steam through locomotive safety valves. As far as possible bituminous coal was substituted for anthracite in heating waiting rooms.

In the work of coal conservation, as in other lines of war activities, the efforts of the railroads throughout the Dominion were co-ordinated, and in a broad way directed, by the Canadian Railway War Board. Not only were fuel-saving measures adopted by various lines themselves, but their efforts extended to effecting conservation of fuel in its larger aspects. Preference was given to coal mines in the matter of coal mining supplies, their demands ranking second only to those of actual war materials. The railroads co-operated with the Fuel Controller in publicity work designed to promote the early stocking of coal, and special attention was given to coal-carrying routes, so as to maintain an uninterrupted flow from Canadian mines or United States gateways to our consuming areas.

In the West the increase of tonnage handled between April, 1918, and the end of the year amounted to 25 per cent more than that handled during the same period in the previous year. The heavier loading of cars also contributed a saving of coal, which has been estimated at 256,972 tons. Through the elimination of duplicate and continual passenger train services an additional saving of 600,000 tons was effected. During the months of January and February, 1918, over 5,000 cars (200,000 tons) of coal were worked through the Niagara gate-

way for points in Ontario, and through the diversion of box cars to the Delaware and Hudson, an increase of 14,457 cars (505,000 tons), destined principally for points in the Province of Quebec, was secured.

On the railroads themselves, employees were drilled in the most scientific methods of firing both on locomotives and stationary boilers; and in round-houses and shops the utilization of scrap and waste wood in place of coal was arranged for. Steam also was supplanted where possible through the utilization of electricity generated by water-power. In all, it has been estimated that not less than 1,000,000 tons of coal was saved by the railways of Canada during the year 1918.

(b) CONSERVATION PROPAGANDA.

Explaining the fuel situation to the public, advocating the necessity for saving coal, and demonstrating practical methods of conservation, were the principal lines of propaganda undertaken by the Fuel Control organization. The channels used included telegraphic despatches to the press, newspaper articles, posters, pamphlets, circulars, bulletins, and lantern slides used in moving picture houses.

In this campaign valuable assistance was rendered by the Canadian Press Association through the Dominion Press News and Feature Committee of that organization. The Director of Public Information at Ottawa was always available and freely aided the Fuel Controller. The newspapers throughout Canada showed a generous spirit in giving space to Fuel Control matters. The motion picture houses also willingly co-operated.

VI. SUMMARY OF RESULTS ACHIEVED.

In viewing any results which the Fuel Control Organization may have been able to accomplish, the fact should not be lost sight of that the work was undertaken at a time when the country was passing through the greatest crisis in history, and financial, commercial and political conditions were in a state of flux. Concurrently with this trying situation, like a bolt from the blue came the winter of 1917-18 which has passed into history as one of the worst in severity with which the coal operators and transportation systems on this continent ever had to contend. The Fuel Control organization having been suddenly called upon to face such an emergency, was also handicapped in dealing with the situation by a lack of adequate data regarding the distribution and consumption of coal in Canada.

Notwithstanding these and other adverse conditions, Canada's importation of anthracite for the coal year ending March 31, 1918, was 600,000 tons in excess of any other year; while the importation of bituminous coal exceeded that of the previous coal year by 4,000,000 tons. After three years of war, Canada had reached its maximum effort: hence the need for these excess tonnages was imperative and fully recognized as such by the United States Fuel Administration.

The efforts of the country to obtain its supplies from the United States, in the second year of the Fuel Control organization, were proceeding very satisfactorily up to the time the armistice was signed in November 1918. At the end of that month, the imports of anthracite from the commencement of the coal year, April 1, were 177,414 gross tons in excess of the tonnage received for the same period in 1916, the year adopted by the United States Fuel Administration as the anthracite basic coal year, while the imports of bituminous were 3,371,243 net tons in excess of the tonnage received for the same period in 1916. With

the conclusion of the war, and the closing of war industries, in the middle of December, the outlook had changed completely, and an abnormally mild winter finally disposed of " the coal situation ".

The annual production of coal in net tons within Canada during each calendar year in the period of the war was as follows:

1914	13,637,529
1915	13,267,023
1916	14,483,395
1917	14,046,759
1918	14,979,213

Not only was the tonnage of coal secured from all sources sufficient to meet the needs of the country as a whole, but also, its distribution was effected in such a way as to provide adequately for individual requirements. In fact, although Canada has on the whole an extremely cold winter climate, it is safe to state that in no country with similar fuel requirements was there as little suffering or inconvenience during the war period, as in this country. Taking into consideration the distances separating the consuming areas in Canada from the mine fields, and the cost of production in Canadian mines, the prices of coal compared favourably with those in other countries.

Prices of coal, whether of foreign or domestic origin, under the coal regulations were fixed on a basis of actual cost plus a reasonable net profit. The following table shows the great expansion in Canadian Export trade during the period of the war annually for fiscal years ending March 31, in:—

1913	$ 393,232,057
1914	478,997,928
1915	490,808,877
1916	882,872,502
1917	1,375,758,148
1918	1,589,661,195

A reference to the report on " The coal trade of Canada ", just published by the Dominion Bureau of Statistics, will show that Canada's consumption of coal has not kept pace with this industrial expansion, which points to the conclusion that Canadian manufacturers have been obtaining greater efficiency out of their coal, as well as making greater use of the country's water powers.

In conformity with the policy of statistical co-ordination, recently adopted by the Government, the statistical data of the Fuel Control organization, bearing on the production, importation, and distribution of coal, at the termination of Fuel Control on the 31st of March, 1919, is to be turned over to the Fuel Section of the Dominion Bureau of Statistics. These data will form the nucleus for further investigations, and should occasion require, an amplification of the work can be undertaken at short notice. The statistical material covering the coal year ending March 31, 1918, is being published by the Bureau in a report headed, " The Coal Trade of Canada ", which it is hoped will be followed by annual reports of a similar nature.

PART TWO.

CANADA'S FUEL PROBLEM.

I. CONDITIONS TO-DAY.

Political and Social

During the past few months, the eyes of the world have been turned towards the Peace Conference at Paris. Upon the successful adjustment of the many difficult international problems being considered by this body hangs to a great extent the commercial and industrial future of Canada, as well as of the rest of the civilized nations of the world. If allied victory is crowned with satisfactory peace terms, the political situation in Europe should be sufficiently stabilized to permit Germany to set her house in order, and begin to repay her national neighbours to some little extent for the injustice done them. Only then will the allies be in a position to undertake in earnest the problem of turning from a war to a peace basis, a transition which under any circumstances holds many economic dangers, and unless carefully carried out, is quite likely to be fully as difficult and dangerous as was the change from peace to war.

Financial and Commercial

During the period of the war the forces of coal operators and distributors of this country were marshalled by the Fuel Control into an emergency fighting organization to back up the expeditionary forces. Now that the war is over there are still extremely important problems to face and tasks to be accomplished. As a reaction to the period of increased prices, high labour, and business expansion generally, which we have experienced during the past few years, we must expect an equal period of decreasing prices of commodities and labour, with a lessened industrial activity.

At the beginning of the war Canada was a debtor nation. At the present time she has reversed this condition and is now one of the few nations with a large annual credit of exports over imports. Canada's fiscal problem for the succeeding years will be to maintain this favourable balance of trade, or as much of it as possible. Only in this way can we expect to meet our national obligations and even then it will be some considerable strain on the country.

Coal Trade

No field offers more scope for national or individual effort towards that end than does the use of thrift in the production and consumption of coal. The coal operators, both in the East and the West, should be encouraged as far as possible to make the most of the domestic markets, and thereby decrease the amount of foreign coal imported. Owing to the many factors involved, such as costs of production, transportation and quality of product, it is impossible to forecast the extent to which the maritime producers will regain the Quebec market; and to what extent the Alberta and Saskatchewan operators will be able to hold the Manitoba market. It is evident, however, that our obligations to foreign countries will be reduced in proportion to the success our own operators attain in the home markets.

Under ideal conditions, however, there is a large market in Canada which Canadian producers have been unable to enter, owing to its distance from the coal fields, and this market has, therefore, been supplied with foreign coal. To what extent this home market can in the future be served by the Canadian product is a problem that requires careful consideration. Meanwhile, in order to make up for this imported coal with its consequent foreign obligation, our

operators should be encouraged to export to available markets, so that Canada's foreign coal trade budget may if possible be balanced with a credit to our country, instead of a deficit.

Shortage of Fuel in Europe

Fuel will play a vital part in the reconstitution of Europe. It is second in its importance only to food, in its relationship to social unrest. A shortage for either domestic or industrial purposes means idleness, discontent and suffering, ideal conditions for the spread of revolution. For several years the European coal producing countries have been unable to fill their own requirements, so that other nations dependent on them for fuel are now in stringent circumstances. While the European producers will no doubt make strong efforts to regain their old markets, and make good this shortage, yet it is unlikely that they will be equal to the demand for some years to come. The situation in Italy and Sweden is reported as especially acute.

In order to develop these markets the coal operators should have a strong organization. In the period of highly intensified competition less will probably be heard of "trust-busting" tactics, and more attention will be given to the legitimate organization of business for the purpose of competing with foreign producers in our own as well as in their markets. Only in this way can they hope to attain measurable success.

II. SOURCES OF SUPPLY—FOREIGN.

(A) ANTHRACITE.

In view of the very considerable concern expressed during the past four years by Canadians respecting the supply of the domestic fuel needs of Ontario and Quebec—which have always depended largely on the United States for their coal—it would seem proper to devote more than ordinary attention to the subject, especially the question of anthracite supplies.

Two phases are here involved. First, the available unmined supplies; and second, the policy of the United States respecting the export of the product of its coal mines.

Available Unmined Supplies

Dealing with the first feature, and having in mind that anthracite is always referred to in gross or long tons (2,240 pounds), the annual production in the United States has increased, in the last fifty years from 15,000,000 tons in 1868 to about 90,000,000 tons in 1918. It will presently be shown that the anthracite fields are capable of supplying a yearly average of 90,000,000 tons for fully another century. It is believed that long before the anthracite mines have reached exhaustion, methods will have been perfected for the use of soft coal, of which there is unlimited supplies. In fact it looks as if the date is not far distant when soft coal will be in general use for domestic heating.

Apart from any consideration of an alternative fuel, it must be remembered, that Canada in view of our severe winters offers an ideal market for anthracite coal, and the producer in the United States sought the Canadian market and obtained it. In other words, there is a certain obligation resting upon the anthracite mines to supply Central Canada and, there is reason to believe that the Government of the United States recognizes that situation.

In dealing with the mineable coal available, perhaps it would be as well to quote somewhat extensively from the report to the Government of the United States by the Anthracite Coal Strike Commission, 1902–03:—

"According to the estimates of the Pennsylvania Geological Survey, the amount of workable anthracite coal originally in the ground was 19,500,000,000 tons. The production to the close of 1901, as previously stated, amounted to 1,350,000,000 long tons, which would indicate that there remained still available a total of 18,150,000,000 tons. Unfortunately, however, for every ton of coal mined and marketed, one and one-half tons approximately, are either wasted or left in the ground as pillars for the protection of the workings, so that the actual yield of the beds is only about forty per cent of the contents. Upon this basis the exhaustion to date has amounted to 3,375,000,000 tons. Deducting this from the original deposits, the amount of anthracite remaining in the ground at the close of 1901 is found to be, approximately, 16,125,000,000. Upon the basis of forty per cent recovery, this would yield 6,450,000,000 long tons. The total production in 1901 was 60,242,560 long tons. If this rate of production were to continue steadily, the fields would become exhausted in just about one hundred years.

"William Griffith (who was a member of the Anthracite Coal Waste Commission, 1887–93), in a series of articles contributed to the *Bond Record* in 1896, considers that the estimates upon which the foregoing computations have been made were too liberal. His estimate of the amount of mineable coal remaining at the close of 1895 was 5,073,786,750 tons.

"In the six years from 1896 to 1901, inclusive, the production has been approximately 308,570,000 tons, which would leave still available for mining, 4,765,216,750 tons. This supply, at the rate of production in 1901, would last a little less than eighty years. But as indicating how susceptible to error are human predictions, it is well to state that in his carefully prepared statements, published in 1896, Mr. Griffith assumes the limit of annual production would be reached in 1906 and would amount in that year to 60,000,000 tons.

"This amount of production was reached in 1901, in just half the time predicted by Mr. Griffith, and the production of January, 1903, as recently reported, shows that the anthracite mines are capable of producing at a rate of 72,000,000 tons annually in their present state of development. It is not to be supposed, however, that the annual rate of anthracite production will continue practically uniform until the mines are exhausted and then suddenly cease. Portions of the fields have already been worked out, others are rapidly approaching total exhaustion, while others at the present rate of production will, it is calculated, last from seven hundred to eight hundred years. If we can assume the annual production will have reached its maximum limit at between 60,000,000 and 75,000,000 tons, and that the production will then fall off gradually as it increased, we may expect anthracite mining to continue for a period of from two hundred to two hundred and fifty years.

"This estimate is based upon the assumption that the available coal will remain at about forty per cent of the reserves. How much this may be increased by better mining methods and the utilization of former waste material, it is impossible to say. Already a large amount of fuel is being recovered from the old culm banks, and it seems safe to

predict that the coal saved will, in the near future, equal fifty per cent of the contents of the field worked. However, we may make our estimates of future production, it is apparent that the maximum output has been almost, if not quite, reached. The production henceforth will be from lower levels and thinner seams than those previously worked. This will necessitate greater expense in mining and, consequently higher prices for the fuel. With higher prices will necessarily follow more economy in consumption, greater restriction of the market, and the increased competition of other fuels. All conditions seem to combine for the conservation of the supply of anthracite coal".

In commenting on the foregoing, Edward W. Parker, Director of the Anthracite Bureau of Information, Washington, D.C., quite recently stated:—

"Of course, conditions have changed considerably since this report was written sixteen years ago. The production has materially increased, but this increased production has probably not resulted in any change in the prospective life of the coal fields, for the reason that the percentage of recovery is now so much greater than at the time the Commission's report appeared that the region could stand fifty per cent increase in annual production as compared to what it was in 1902 and not increase the rate of exhaustion.

"As will be noted in the foregoing extract, percentage of recovery in 1902 was estimated at forty per cent of the contents; that is for every ton which was mined and marketed one and one-half tons were lost. At the present time it is probably safe to assume that the recovery is fully sixty-five per cent of the coal in the ground, and in some properties it is considerably more than that.

"It is generally known that anthracite is now being produced from beds that were not considered among the available reserves at the time the Anthracite Waste Commission made its report. There are numerous instances of properties which were abandoned as exhausted a quarter to a half a century ago that are now being re-worked, and in some instances are producing more coal than they did before they were 'abandoned'. At the same time there are many properties from which no more than forty per cent has been taken, which are permanent wrecks and will not yield any more tonnage.

"It will be noted from the above quotation that the production up to the close of 1901 amounted to 1,350,000,000 gross tons. It seems scarcely possible that in the seventeen years from 1902 to 1918, inclusive, the production should have practically doubled the total production to the close of 1901. Such is, however, a fact, for the total production to the close of 1918 is estimated to have been a little more than 2,600,000,000 gross tons, or 2,913,000,000 net tons.

"It is customary to consider that for this entire period the tonnage lost was equivalent to the total amount produced, so that exhaustion to the close of 1918 was something over 5,000,000,000 gross tons, and out of the total estimate of the original contents of 19,500,000,000 gross tons, leaves still in the ground 14,500,000,000 tons. The rate of production at the present time is about 90,000,000 gross tons annually, and if we consider that for every ton marketed, one-half ton of coal is lost, it means an annual exhaustion of approximately 135,000,000 tons, which would indicate the life of the field, at the present rate of production, would still be about a hundred years.

"In making this statement the estimate of the Coal Waste Commission only has been considered. The figures contained in this report, as previously stated, did not include certain thin beds which, at the time the Commission made its investigations, were not considered among the available reserves. What the contents of these beds would amount to has not been even approximately determined. It might be stated in millions or in billions of tons. Consideration, too, must be given to the fact that production of anthracite will not be maintained at an approximately uniform rate until the coal is entirely exhausted and then suddenly cease. We are now probably at the maximum of production and the present rate should continue, with naturally some variation, from year to year, due to market conditions, for a number of years or several decades, and then gradually decline. What the rate of declination will be is, of course, indeterminable, but it is probable that some anthracite will be used for one hundred and fifty or two hundred years to come."

The Policy of the United States with respect to the Exportation of Anthracite Coal

From the foregoing it is fairly clear that if the demand upon the anthracite supplies of the United States does not exceed 90,000,000 tons annually, there is sufficient for another one hundred years. The probabilities are that this demand has now reached the peak, and that before many years it will decline, for two reasons, namely, (1) the cost of mining is likely to continue high; and (2) soft coal, more cheaply mined, and of which there are vast reserves will, no doubt, make inroads on the anthracite market.

Should any one be alarmed about the coal supplies of Canada and the United States, it is only necessary to point out that an estimate made in 1910 gave the reserves of coal of all kinds in the United States, with its 100,000,000 people as being 4,231,352,000,000 tons, while Canada, with its population of 8,000,000, has 1,360,535,000,000 tons. The geographical distribution of the supplies in Canada and the United States is interestingly shown by diagram in the appendices. The output of the United States mines for 1918 was 585,560,522 tons while that of Canada was approximately 15,000,000 tons. Great Britain, that hive of industry for generations, is credited with 208,922,000,000 tons reserves, small in comparison to Canada's supply.

The fact that the anthracite output in the United States is largely controlled by a few powerful companies has from time to time caused more or less uneasiness in that country, as well as in Canada. The Government has on different occasions appointed committees to investigate the operations of these companies, and inquired into their methods of mining and their manner of conducting their business generally. But as far as the Fuel Controller is aware, nothing has ever developed in these investigations, which would indicate any desire on the part of the United States Administration to prohibit the exportation of anthracite. During the crisis just past, Canada was treated almost, if not absolutely, as an integral part of the union. Of course, it is within the realm of possibility that at some future date the United States might desire to retain their whole supplies of anthracite for the use of their own people. In such an eventuality, Canada would no doubt be given several years notice within which to arrange for replacing such supplies as are then being imported.

(B) BITUMINOUS.

Policy to adopt in Purchasing Bituminous

From the foregoing it will have been seen, that while there is sufficient anthracite to last approximately one hundred years, the supplies of bituminous are practically inexhaustible. In addition there is this added advantage to the bituminous user, that the supplies of this class of fuel are not controlled by any one group of large companies, and

are so vast that even at this date lands underlain with coal may be purchased at reasonable figures.

The States of the adjoining republic upon which a large portion of Central Canada—Ontario and Quebec—has depended in the past for industrial coal are Pennsylvania, West Virginia and Ohio. Owing to various geological factors, the quality of coal varies in the different states and mining districts, and to some extent, in the different mines in the same district. Each of these states have noted coal seams, such as the Pittsburg seam in Pennsylvania, the Pocahontas and Kanawha in West Virginia and the so-called "Hocking" of Ohio. In addition to the numerous seams, of which there are 102 in the State of West Virginia alone, the issue is somewhat further confused by the use of trade names. As in any other business integrity counts for much, and it is a very desirable policy for all users of bituminous coal to form a connection with some reliable concern whose position is a satisfactory guarantee that they will not misrepresent their product; and, what is more important still, will take care of their customers' requirements throughout periods of stringency.

In forming this connection several important principles should be kept in view. The requirements of the individual power or heating plant should be studied, and it should be known in advance which size and grade of coal at a given price produce the best results under its peculiar operating conditions. The coal should come from the nearest available field, in order to take advantage of any possible favourable freight differentials.

When to Buy

Canadian consumers, being some distance from the source of supply, should study closely the market conditions and make a practice of buying at slack seasons. Summer is the ideal time to move coal, and is the only time it can be moved by water. In the early spring, before the lake season is in full swing, and while the market is more or less unsettled because of labour uncertainties, the slackest period at the mines occurs. Many buyers consider it a wise policy to buy their coal at this time even at a sacrifice, rather than to wait for summer in the expectation of lower prices, on the theory that it is worth something to know that their coal is in the stock-pile, and that whatever happens later on, either in the form of labour disturbances or bad weather, their source of power or heat will not be interrupted. The foregoing suggestions are only in line with sound business practice and they might be considered superfluous; however, the Fuel Controller has seen enough to consider he is warranted in drawing attention to these important features in the selection and purchasing of fuel.

III. SOURCES OF SUPPLY—DOMESTIC.

(a) Natural Resources.

(1) coal.

Maritime Provinces

The fuel resources of a country or of its mining areas are limited not only by the actual tonnage underground, but also by its availability, particularly with reference to the cost of mining and marketing the tonnage recoverable. In the past, the Maritime Provinces have led the country in the matter of output, the bulk of the tonnage coming from Nova Scotia. Mining operations in New Brunswick were, until very recently, practically negligible. In looking upon this area as a source of supply for future requirements certain limitations are at once apparent. In Nova Scotia the known available land areas capable of development on any extended

scale cannot be regarded as extensive. The province at the present time, is very largely dependent on her submarine areas to maintain her annual output figure. Mining operations conducted below the floor of the ocean can, of course, only mean added costs, and as the workings are carried further out under the water, these costs will increase, there being among other factors, the necessity of working from the land side of the area, with the consequent one-sided development and increasing underground haulage, which means as well more road mileage to maintain. Another feature is that the presence of gas in many instances makes it impossible to use electrically driven labour-saving machinery.

The demand for coal for industrial purposes in the Maritime Provinces is still light. With the exception of the steel companies the principal consumer has been the Intercolonial Railway—a road that cannot be credited with having at any time been prosperous. It is a fairly correct statement to make, that prosperity in the mining industry cannot be expected so long as the main consumers of their product are none too successful. About one-third of the tonnage lifted from Cape Breton mines has, in recent pre-war times, been sent up the St. Lawrence river, largely for the Montreal and tributary markets. In the winter, however, these markets have very largely been cut off by ice, necessitating added costs in connection with storage facilities until markets again become available.

Future Market Possibilities

It is doubtful if the limitations mentioned will be in any way greatly lessened as time goes on. If, therefore, coal from the Maritime Provinces is to hold its own in the markets in which it has heretofore figured, mining operations must of necessity be held down firmly to a competitive basis. It is not sufficient merely to mine coal. It must also be mined at a figure that will give a reasonable return on capital invested, and at the same time a reserve must be built up that will refund the investment during the life of the mine, for coal is a crop that is harvested once for all. In addition to the coal that has in normal times been reaching St. Lawrence River points, considerable tonnages have been going to the New England States, and as in the past the Nova Scotia product will doubtless continue to meet, in these markets, very formidable competition.

The Pennsylvania mines are operated under extremely favourable conditions, so far as cost is concerned, and the fact that boats and cars carrying grain and iron ore southeastward would return empty, if coal were not available for shipment, enables transportation companies to quote abnormally low rates on coal moving north and west. In consequence, large tonnages go to points along the Great Lakes, which contributes to an all-year-round market for the product of United States operators. In the summer their tonnage goes to the northwest and across the lakes by water, and in winter the nearby industrial areas in the United States and Canada absorb their output by rail. Their organizations are thus kept intact and their "overhead" spread over the entire twelve months. In these facts lie another reason for the necessity of the most rigid supervision of maritime mining operations for the purpose of reducing costs.

On the other hand, certain advantages possessed by the maritime coal areas should be noted. Outside of the small deposit of Rhode Island anthracite, which is too hard for present commercial utilization, our maritime deposits stand alone on the entire length of the Atlantic seaboard of this continent. With Pictou county as a centre, a circle with 800 miles of a radius could be drawn without touching any other mining areas, and in Canada no coal of a similar class is to be found short of the coal fields in the Rocky Mountain district in Alberta, fully 2,500 miles distant. No outstanding economic obstacles are now evident which

would offer insurmountable difficulties to a much increased industrial development in the territory adjacent to the maritime coal fields.

By comparison with Alberta, the mineable tonnage in the Maritime Provinces is small. Taking, however, the maximum annual output in pre-war days, namely, about 8,000,000 tons, and allowing 50 per cent for waste and supplies left in the ground,making 16,000,000 tons, it would appear as if the supplies would hold out for another 700 years. Of course, the coal-mining industry in the Maritime Provinces unquestionably will go far beyond an annual output of 8,000,000 tons. Much, however, will depend upon cost of production and capacity to compete with other coals in markets outside of those provinces. The coal-mining industry in that part of Canada cannot be said to be in a satisfactory condition. That is also true, but to a much less extent, of many of the districts in the United States. Money has been lost in mining, which is not uncommon. Companies struggling to continue in operation, have sold their product without sufficient profit. That of course means but one thing—a running-down in equipment. Nothing would do more to bring certain struggling coal companies up to a fair standard of efficiency than for the railway companies to give contracts for their coal supplies for a term of years, at cost, plus a fair percentage of profit, provided the coal companies made the necessary expenditure to equip and maintain properties with all appliances to enable production to be carried on at a minimum of cost.

Ontario

It is customary to say that there are no fuels other than vast peat areas between the Maritime Provinces and the western plains. While to all intents and purposes that is true, so far as available fuel is concerned, still, according to Dr. D. B. Dowling of the Geological Survey, there are beds of lignite in Northern Ontario, tributary to James Bay, but these under existing transportation conditions are of no commercial use or value.

The Western Fields

Canada's greatest supply of fuel is in the middle west—Alberta, with certain lignite fields in Saskatchewan. The mining of coal differs from most of our other industrial enterprises in at least two important characteristics. In the first place, the raw material is limited. A farmer may increase or renew the productivity of his farm by using a fertilizer. A secondary supply of lumber may ultimately be provided by reforestration of cut-over areas. But coal once extracted from the mine is gone forever and can only be replaced by some form of substitute. Consequently, the miner is under the necessity not only of providing for his operating expenses and his profit, but of arranging to regain the cost of his original initial investment, during the comparatively short life of his mine, probably an average of twenty-five years.

In the second place the demand for coal is not constant, with the result that mining is subjected to sudden extremes of activity followed by periods of complete stagnation. In the main, the variations are coincident with the seasons. This condition is not confined to the mines of Alberta, or of Canada alone, but is prevalent in all coal mining districts. It is even true, though to a less extent, of the Anthracite mines of Eastern Pennsylvania, but the disadvantage is less apparent because this coal will store more readily than any other. Not only are the costs indirectly increased by this irregular operation, but the class of labour cannot be maintained at a general high standard where the employment offered is of a spasmodic nature. The price of coal, therefore, depends in a large measure on the question of whether the above conditions are present in a mild or aggravated form.

What the coal-consuming public does not appear to appreciate is that the closing of a coal mine is not as simple as putting a padlock on the door of a building —the interior condition of which will be pretty much the same when opened to use again in the future. The underground workings in a mine must be kept in

repair constantly, otherwise the roof will cave in both in the haulage ways and in the producing sections of the mine. It is well within the mark to say, that when mines are worked intermittently the cost may exceed by fully one dollar per ton, the cost of production if operated continuously.

Necessity for Stabilizing the Industry

The future problem of the Western coal fields with their enormous reserves of easily accessible coal is not so much a case of production therefrom as it is of finding a market. With the present development the mines in Alberta and Saskatchewan are capable of taking care of a much increased demand with little or no addition to their equipment and plants.

To increase their market the costs of production must be carefully studied, and the most modern methods employed for extracting and transferring the coal to market. It might as well be clearly understood at once that the fullest co-operation must exist between the consuming public and the operators. Too little heed has been paid in the past by the consumer to the difficulties of the operator and those engaged in the trade. The attitude of the consumer has been: "When we need coal, the trade must have it available." With such a policy, intermittent operation of the mines is unavoidable and results in high-priced fuel. The people of the western provinces doubtless appreciate the importance of developing their own natural resources. To obtain the maximum results in that respect, much greater interest must be taken by them in the matter of purchasing, storing and using their own fuels.

Adjustment of Prices and Rates to promote Early Buying

In order to encourage the buying of domestic coal in the spring and early summer—the slack season—the price no doubt could be graduated on the same basis as has been done under normal conditions by the anthracite operators in Pennsylvania, namely, by making a reduction of fifty cents per ton on April 1, followed by a monthly addition of 10 cents per ton to the price until by September 1 the former price has been regained. Further, in order to take the strain off the railroads during their busiest season, namely, during the autumn and early winter, which is also the period of greatest demand for fuel, it might be possible to work out an arrangement with the railroads for a reduction in the freight rates during the summer, or at least a rearrangement of existing tariffs, so that there would be a further inducement for buying fuel in the spring and summer, and thereby assist in stabilizing the industry. For this is at once the season of greatest steam efficiency, lowest cost of operation, and least amount of freight traffic.

Storing Lignite

The main difficulty in handling domestic supplies of lignites in summer is their tendency to slack under exposure. It is believed that this can largely be overcome, in rural sections at least, by storing say eight or ten tons in pits adjoining the house. If promptly transferred from the railway cars to the consumer and covered in pits, it probably would be found in November, when required, quite equal to the fresh mined product. At any rate, it is of sufficient importance for operators to demonstrate it by practical tests. The storage of lignite in pits for domestic purposes is only a temporary expedient. The time is approaching when briquetting will be adopted.

The production of coal in western Canada is far from being on a satisfactory basis—a fact that is true of the industry in other coal fields of the country as well. Canada is a land of great distances and a sparsely settled population. The question is one of market and transportation, and as has already been pointed out, the consuming public, especially in the west, is making no effort to adjust its needs to those of the operators. However, these difficulties are only tempor-

ary. The possibilities of development in western Canada are so vast that there is a great future for its coal mining industry.

British Columbia

This province possesses large areas of coal lands, the principal developed districts at present being on Vancouver island, where some of the seams, as in Cape Breton, extend out under the sea. As elsewhere, costs of production mounted upwards during the period of the war, in some mines to quite high figures indeed.

The domestic market in British Columbia is naturally light. To what extent foreign markets can be enlarged for the product is difficult to forecast. It will depend largely on the ability of the Canadian operators to compete with coal reaching United States Pacific Coast ports from the interior of that country.

(2) PEAT.

Industry undeveloped.

During the more strenuous coal shortage of the past two years, time and again the Fuel Controller was asked what his organization was doing in the way of facilitating the production of peat. The peat industry had not reached a commercial basis; consequently it was no time to look for any relief from the country's undeveloped peat areas. What the possibilities for successful production of peat in Canada are, has yet to be determined.

The fact that the requirements of the "acute fuel area" of Canada have in the past been supplied mainly from outside sources, naturally leads to inquiry as to what extent their own resources could be made available for fuel needs. Since Europe uses about 20,000,000 tons of peat annually, the question arises whether Canada could not utilize as fuel the extensive peat deposits known to exist, expecially in Central Canada, where coal deposits are unknown. Comparatively little progress has been made in this direction up to the present time. No peat was produced in Canada in 1917, and 300 tons only in 1916, while the maximum production in pre-war years was 2,600 tons in 1913.

Peat Areas in Canada

There are 37,000 square miles of good peat bogs in Canada, as determined by the Mines Branch, Department of Mines. Where a territory has coal resources of its own, it is obvious that those resources will be used in preference to peat. Each of the Maritime provinces has peat bogs, and they are found also in the provinces west of Manitoba, but as these territories have their own coal deposits, the manufacture of peat fuel therein on any reasonably large scale would prove economically a failure. The question therefore, narrows down to a consideration of the resources of the central provinces.

These provinces are generously supplied with peat bogs, having in all about 12,000 square miles. It will at once be apparent, however, that the mere presence of peat deposits, even in readily available localities, does not necessarily render peat manufacturing a feasible venture. The governing factor is, of course, at what cost this fuel can be made, and how this cost compares with the equivalent fuel value of coal or wood or any other class of fuel that would come into competition with it.

Methods of Production

There are two processes of treatment, namely, one involving natural agencies—the sun and wind for drying—the other in which the product is mechanically treated. It is understood the former is the only economical method to follow—at least in this country. As to the former, before the war a plant erected and operated at Alfred, Ontario, under Government auspices, afforded some demonstration of the possibilities,

and was followed by the erection of a plant with the object of manufacturing peat on a commercial scale. The outbreak of the war, however, interfered with these plans, and the project had to be abandoned for lack of capital.

Those who have used machine made peat in their homes appear to be very well satisfied with it, and claim that it burns with a blue flame, yields an intense heat and leaves no soot. In open grates, as a substitute for cannel coal, it is admirable.

Utilization of Peat Fuel for Industrial Purposes.

Apart from its fuel value for domestic purposes, B. F. Haanel, of the Mines Branch, is authority for the statement that "Peat has and is being successfully utilized to-day for the production of power through the medium of the steam generator and steam engine, and the gas producer and gas engine, especially in the case of the latter with the by-product recovery gas producer." Combined with artificial asphaltum composed of coal tar and limestone, it may be used for pavements, and it is said to form a solid and elastic road, the tendency to crack and break being counteracted by the strong fibre of the peat. It may be used for building purposes in the same manner as, or as a substitute for, terra cotta and papier mache. For this, it is cut into blocks and subjected to hydraulic pressure to shape it. Then, if necessary, it may be treated with some material which will fit it to resist moisture.

The fact still remains that the economic production of peat in Canada has not yet been successfully accomplished. It may be found impracticable for some years yet to place peat on the market in competition with coal, Quite recently the whole question has been placed in the hands of a board of investigation, known as the Peat Committee. On this committee there are four members, two of whom are appointed by the Dominion Government, and the other two by the Ontario Government. R. A. Ross, of Montreal, and B. F. Haanel, of Ottawa, are the appointees of the former, and A. A. Cole, of Cobalt, and R. C. Harris, of Toronto, of the latter. These gentlemen are at present engaged in an investigation of the peat bogs of the Dominion, with a view to establishing their utility as a source of fuel. The time is ripe for a definite pronouncement on the subject, and it is expected that the Peat Committee will state their conclusions in the near future.

(3) NATURAL GAS AND OIL.

Provincial Supplies

In the maritime area, New Brunswick is the only province which has so far produced either oil or gas in commercial quantities, and would appear to be the only eastern province which holds any considerable latent possibilities for the prospector. No showings whatever have been found in Prince Edward Island, although geologists admit the possibility of the discovery of oil or gas at great depth in certain localities on the island where the geological structure is not unfavourable. The best opinion seems inclined to the belief that oil and gas are not present in the strata of Nova Scotia in commercial quantities. There are, however, deposits of oil shales in both New Brunswick and Nova Scotia, which have been the subject of study and experimentation for a number of years, and in the future may quite probably form the basis of an industry whereby oil may be recovered therefrom by mechanical means. At the present time there are no indications that either oil or gas will be discovered in sufficient quantities to modify to any extent the present demand for coal for domestic or industrial purposes.

In the Gaspé peninsula of Quebec some drilling has taken place, and oil secured in what appeared to be commercial quantities, but these operations proved unsuccessful financially, and have been since abandoned. While opinions differ as to the possibilities of a further development of oil and gas fields in

Quebec, practical geologists are skeptical of future discoveries on a commercial scale.

Ontario, of course, has been the leading province in the production of both gas and oil in Canada to date. Unfortunately, in the early days of the development of the industry in this province, the properties were badly managed, with as a result untold loss to the people of Canada. Gas from the Kingsville field in Essex county was piped to Detroit, and owing to the excessive demand the wells were soon overstrained, and the field was absolutely ruined by an inrush of salt water. The life of the field, which otherwise under proper treatment should have been sufficient for the needs of the residents of Western Ontario for many years, was then cut short. A similar case occurred shortly after, when gas from the Welland field was piped to Buffalo. This field was likewise overtaxed, with the same result. Since then the Government has taken action to limit the exportation of gas and otherwise restrict its distribution. During the winter of 1917-18, the people of Western Ontario, who had in the past depended mainly on gas for domestic fuel, were much agitated over the threatened failure of the gas production, and the Provincial Government took steps to further restrict the use of gas, limiting it to domestic users entirely.

Of the western provinces, Alberta has taken the lead in prospecting and developing her oil and gas resources. While traces have been found both in Manitoba and Saskatchewan, they have not been in commercial quantities, and the opinion seems to prevail that the geological structure does not warrant much being accomplished from further exploration work.

While public sentiment is against the granting of large concessions to capital, nevertheless it is desirable to transfer hidden underground wealth to the surface and have the same put to beneficial use, incidentally yielding revenue to the country by way of taxation. It is just possible that greater incentive would be given to find such wealth if important concessions were available for those financially capable of carrying on drilling and other explorations at considerable expense. The public interest might be protected by providing that the profits from the venture over and above some fixed percentage, should be invested in the establishment of permanent industry in the country.

(4) WOOD.

Difficulties Affecting Supplies.

There is probably no other one subject which has during the life of the Fuel Administration monopolized more attention from the general public than that of the various aspects of the wood reserves of this country. The popular imagination was impressed with the fact that in the northern parts of Canada are immense areas of standing timber waiting to be cut. What was generally forgotten, however, was that the transportation and labour factors are quite as important to the accumulation of wood supplies as they are in the mining and distribution of coal.

In the crisis of our fuel problem through which we passed, it seemed difficult for our neighbours to the south, upon whom we depend for a considerable portion of our coal, to understand why Canada could not take care of her needs from her vast supplies of wood. Two principal reasons existed. First, Canada in the main has long since abandoned wood consuming heating equipment; secondly, a still more potent reason was the fact that Canada mobilized practically all her available wood choppers and sent them to Europe in connection with the forestry work there. An estimate of the services rendered by that force prepared by the Commission of Conservation indicates a "saving of ocean tonnage equivalent to feeding fifteen million people."

Wood supplies could and should be used in Canada as winter is approaching, and again in the early spring season. The question of unemployment is more

or less serious in every country. For instance in Canada, the farmer requires additional help for a few months in the summer. The larger cities provide employment for large numbers during the same season, but what becomes of them all in the winter? Our wood problem is largely a question of mobilizing such labour. It means the co-operation of the municipality and its provincial Government, in those provinces, with large supplies of timber. By some such arrangement wood could be cut, cured and made available for use, as pointed out, at both ends of the winter. The whole plan should be part of a systematic programme of a reforestration scheme in the older sections of Canada. The timber resources of Eastern Canada are rapidly being exhausted, and the time is now at hand for the people to take greater interest in renewing our forest wealth. It seems proper to suggest that we are far too indifferent about this matter; as a people we should be keenly alive to the work of our Commission on Conservation and the National Forestry Association, both of which bodies have been very active in this direction.

(5) WATER POWERS AND ELECTRICAL ENERGY.

In the Industrial Field

Canada is a country with wonderful possibilities in electrical energy to be developed from her natural waterways. That she has already taken advantage of part at least of these resources is shown by the fact that on January 1, 1918, 1,652,651 horse-power, which is 89·6 per cent of all the power-producing capacity of the Central Stations in Canada, was developed from water-powers.

Conservation Large Steam Power Stations

Great Britain has no large water-powers, but, appreciating the economic value of large central station power-generating plants, and the merits of electrically transmitting and distributing power, her "Coal Conservation Sub-Committee of the Reconstruction Committee" has reported, under date of April 17, 1917, that some 60,000,000 tons of coal can be saved annually by shutting down the vast multitude of small steam-power plants throughout the country and generating power in a few efficient super-steam stations.

Railway Electrification

In pursuance of the same policy of conservation, according to the reported utterance of Sir Eric Geddes, when discussing the Ministry of Ways and Communications Bill some days ago (March, 1919), Great Britain will promptly undertake to electrify her main line railways if the Bill becomes law. From one-half to two-thirds of the coal consumption of railway locomotives can be saved in England or elsewhere by the construction of large central steam power plants. But Canada can save the whole of the coal now consumed by railways in those provinces where water powers abound. In this latter connection it would be well, in the opinion of the Fuel Controller, for the managements of all the Canadian railways to investigate the possibility of electrifying the portions of their systems where traffic is densest, in Ontario and Quebec, for example, with the view of not only making the best use of existing tracks, but also with the view of conserving coal by taking advantage of the many water-powers within economic transmission distances of the districts in question. Such investigations and the electrification of existing lines might easily result in the postponement for many years of further railway building in such territories.

Conservation.

The steam railways are large users of coal, and as is well illustrated in the case of the Montreal Tramways Company, referred to hereafter, they can make tremendous coal savings if electrified and operated with power from waterfalls. The conservation of coal and labour; the release of railway equipment and facilities for other purposes;

the elimination of the fire hazard, to say nothing of the smoke nuisance now occasioned by steam locomotives; the increased capacity of existing trackage, yards, and shops; and the superior ability of the electric locomotive to maintain higher schedules under adverse weather conditions, are some of the reasons for the urgent necessity of carefully considering the early electrification of busy sections of steam railways. As water-powers in abundance are located within practical transmission distances of all the large centres of population in Ontario and Quebec, the development of some of these powers is a matter which should be studied jointly with the railway electrification problem.

Steam Power Plants

Coal used for producing power alone is said to be a degrading use of coal, because in locomotives and small stationary steam plants, for example, only about 4 per cent on an average of the energy in the coal is converted into and becomes available for use in the form of power. In the largest and most modern steam power stations an efficiency of 20 per cent has been attained, and this is the reason why Great Britain is giving so much attention to the construction of super-steam plants to replace the multitude of inefficient boilers and engines throughout the country.

When the energy of coal is turned into heat alone an efficiency of eighty per cent may be obtained, and this is why combined steam heating and power plants are so much more economical than steam plants used exclusively for power. But, that even those combination steam heating and power plants, with the limitations inherent in all small plants, cannot operate as economically as mammoth central stations, is shown in the following cases presented to the Public Service Commission in New York in March, 1918:—

COAL CONSUMPTION (YEARLY), ISOLATED PLANTS AND CENTRAL STATIONS.

Plant.	Former coal consumption, light, power and heat.	Coal now used for Heat only.	Coal used at central station for light and power.	Coal saved.	
	Tons.	Tons.	Tons.	Tons.	Percentage.
A	1,316	542	159	615	47
B	7,237	2,927	1,403	2,907	40
C	2,107	1,113	193	801	38
D	750	240	178	332	48

Other reported cases showed savings of 16 per cent, 19.8 per cent, 33 per cent' 45 per cent, 53 per cent, 59 per cent, and 67 per cent annually. It was only in a few cases where a considerable amount of steam was needed for some manufacturing process or purpose besides power, that very large savings could not be effected by shutting down the isolated power plants, and purchasing light and power from a public service company. The Fuel Controller is of opinion that good reasons should be shown before any isolated steam power plant is now permitted to be built or even continued in use, in any part of Canada where water-power is available. Power production by coal consumption under such conditions is a misuse of coal, which should not be tolerated.

Electric Heating

Electric heating, with energy from hydro-electric plants, is a problem which the public seems to like to discuss. But the Fuel Controller is of opinion that the substitution of electrical energy for fuel in domestic heating cannot play an important part in solving

Canada's fuel problems. There are three reasons for that conclusion: first, although the potential capacity of our water-powers is enormous, they are insufficient to electrically heat our present homes—to say nothing of future growth, and at the same time to meet our light and power requirements; secondly, the tremendous cost of the power plant and of the power-transforming and transmitting equipment—all of which would of necessity be in use at the same time in cold weather, and none of which would be needed for heating in warm weather—puts electric heating beyond practical consideration; and, thirdly, because the proposal to use electrical energy for heating is based upon unsound scientific principles. When electrical energy is to be transmitted from one point to another, wires of ample dimensions are employed so that the resistance losses—analogous to friction losses in a water-piping system—shall be reduced to a minimum. Electrical energy is a high grade type of energy, which should not be wasted. But in the ordinary electric heater the heating element is in the form of resistance, and all the electrical energy in question is thus " degraded " from a high type of energy to a low type.

It requires about 25 horse-power of electrical energy to heat a well-built eight-room house. Ottawa, with a population of about 100,000, had some 25,000 buildings of all types. To electrically heat 20,000 houses, for example, each needing 25 horse-power, at the same time would entail a power plant and transmission installation of 500,000 horse-power; this is 25 per cent more power than the total capacity of the three large power companies at Niagara Falls, Ontario, and it is about five times as much energy as is normally available from the whole of the Ottawa river at Ottawa and Hull.

To obtain for one hour 25 horse-power in the form of mechanical energy from coal in a steam-power plant, requires in plants of 1,000 to 2,000 horse-power, the consumption of about 100 pounds of coal. But to obtain the equivalent of 25 horse-power for an hour from a coal-burning furnace, in the form of heat, only requires the consumption of less than 10 pounds of coal—even when 50 per cent of the heat is lost " up the chimney." Therefore, by making proper use of power from water falls, more than ten times as much coal can be saved by replacing steam engines by electric motors, as could be saved by replacing coal furnaces by electric heaters.

If we had so much water-power, developed and undeveloped, that there was no economical use for it, now or prospectively, there might be some excuse for advocating electric heating. But when ten times as much coal can be saved at every point where electric motors replace steam driven machines, as could be saved by the same amount of energy used for electric heating, our conservation efforts should be centred on the electric power question—not on the electric heating question.

The connection of electric heaters to new power plants which have spare capacity, tends to create conditions most difficult of correction later on when the power becomes needed for more economical operations. In this respect it is analogous to the exportation of power in the early days when there was no demand for it in Canada. When the use of power—or the enjoyment of any privilege—is once established, the attempted revocation of that use or privilege may be attended by very difficult and complicated consequences.

As an instance of what may be accomplished in the conservation of coal by using electricity to take the place of mechanical energy created from coal, it might be pointed out that in Montreal, at the instigation of the Fuel Controller, some 43,350 tons of coal were saved during the twelve months ending March 31, 1919, as the result of an arrangement whereby the Montreal Tramways Company purchased power from the Montreal Light, Heat and Power Company as an auxiliary supply. Similar arrangements have been made with

twenty-seven other users of coal in the Montreal district, effecting an additional saving of over 1,200 tons yearly. In other parts of Quebec province over 25,000 tons were similarly saved last year.

The municipal corporations of Montreal and of Winnipeg had opportunities to effect yearly coal savings of about 30,000 tons and 10,000 tons, respectively, by purchasing power on the one hand for pumping water at Montreal, and, by selling power in the other case to the street railway at Winnipeg; but as these municipalities did not take advantage of the situations arising out of the Fuel Controller's appeals for conservation, those possible savings cannot now be recorded.

(B) Economic Features.

(1) NATIONALLY OWNED COAL MINES.

Situation in Great Britain.

In view of what is happening in England at the present time, some reference will doubtless be expected in this report to the subject of the State embarking in the coal mining business. It is one thing to have public ownership forced upon the country, as in the case of a considerable mileage of the existing Canadian national railways. It is quite another thing to go into the business of public ownership and operation, of our own free will, on the assumption that such a course is in the best interests of the nation.

This seems to be the direction in which England is moving at the present time. It is an experiment, however, that will be watched with keenest interest by the other great coal-producing countries. The Fuel Controller supports the view that the country's natural resources—the people's property—should be administered in such a way as to be of benefit to all the people. It is a question of method. That is, as to whether the object in view can best be attained through private initiative under government supervision, or through state enterprise. There is in the country a large body of sentiment against the former method. Public control frequently has not been what it might have been, and it is a reasonably safe statement to make that if governments cannot successfully control, they cannot very well be expected to successfully operate a merchandising business.

Public Enterprise and Public Backing.

It is not contended that government operation is not possible, but it seems sound to look for success in the matter of adequate control before committing the country to the further step of management. It is not usual for any section of the proprietors of a commercial undertaking to assume that the management is not giving the very best service. As a rule they are almost unanimously behind the men in charge of their property. That is essential for successful management. Will anyone say, however, that such a feature will be true of government operation? Those in control of every business occasionally make mistakes. No one is infallible, but let the National Railway lose half an hour on any occasion, and the public will be far more critical of it than over a similar loss of time on the privately-owned road.

In any event the Fuel Controller is of the opinion, that before going further government control should first be properly tried out, and especially is this desirable and, in fact, necessary, in view of the tremendous financial obligations that now rest upon Canada, without taking on the very large additional burdens of acquiring the coal mines throughout the country. The coal mining industry in England has been very profitable. That, however, is not the situation in Canada. The moment a struggling industry becomes over-capitalized

and is unable to pay dividends on its issued stock, the enterprise is embarrassed through difficulty of obtaining money for necessary capital expenditures. That condition is not, of course, confined to over-capitalized projects, or to the mining industry alone, as the history of the earlier undertakings in every country contains evidence of many financial disasters.

Submission of Cost Data Essential.

There are undisputed advantages in unification of management or supervision, and the Fuel Controller is firmly of the opinion that all mines should be forced to submit in confidence to the Mining Departments of the Governments under which they operate, monthly cost sheets, showing on standard forms, units of costs, together with other necessary information. In that way the relatively high costs are exposed, and knowing them, the operator will naturally endeavour to bring them down to where they should be. On the other hand, if the operator is taking excessive profits, they will at once be evident from such cost sheets. Through information of that character being available, it should be possible to give mining labour, as well as the consumer of coal, all necessary protection.

(2) LABOUR.

A New Era.

Society is an organism, the development of which is governed by natural laws as is the growth of man himself. And while it is true that the progress of a nation may often seem imperceptible, or on occasions even appear to be a retrograde movement, yet, nevertheless, having in mind the broad trend of events, we are unquestionably moving forward to better things all the time. As a part of the growing process many forces are constantly striving to move upwards, in a constant succession of action and reaction. Periods of prosperity, with business expansion, and rising prices, are followed by considerable intervals of depression, with falling prices and deflation of business. In normal times we have the employer and employee representing two fairly equal forces. In the lean year periods the policy of the employer, in the main, has been to force the employee back from some of the ground he has been occupying. To some extent this may have been necessary to retain markets. But the danger lies in being too aggressive in the pushing. Then the prosperous years come around, and the employee takes a corresponding advantage of his strength, and in the struggle, the movement of the pendulum from the one side to the other, strikes and lockouts have occurred. Faults have existed on both sides. It could not have been otherwise with the methods which in the past have largely prevailed between the two classes.

As an aftermath of the great war, humanity now has an entirely new outlook. The standard of living must be kept moving upwards. Questions relating to such substantial matters as the rates of pay, or the hours of work, are being superseded by those of psychological nature, more or less concerned with the promotion of the idea of an industrial democracy. Hereafter it will not be enough to be governed in the fixing of wages by the absolute need of the individual seeking employment; nor, on the other hand, will it be sufficient for labour to put in, indifferently, the requisite number of hours weekly, concerned mainly in the arrival of pay day. If the labourer is worthy of his hire, he is also worthy of a share in the success of his employer. On the other hand, it is the function of the labour organization to see that their members are worthy, to see that efficient service is rendered. If they should fail in that respect, the pendulum in a very few years will be swinging as of yore. While the war has done much for democracy, it has not purged humanity of selfishness, and we

still have a very long way to travel upward before the policeman can be removed from our streets. Meanwhile, he is not kept there to watch any particular section of society.

An interesting graph is given in the appendices entitled "American Commodity Prices from 1860." This has not appeared officially, but doubtless it is quite correct. The object in presenting it in this report is to show what happened to prices in the United States during the Civil War and a short period thereafter. A graph of prices that prevailed in France during the same period would show much less extreme fluctuations; while during the Franco-Prussian war the situation in the matter of commodity prices in the two countries would be reversed, because the crisis in each case was more or less localized. The entire world has been, and will continue to be influenced by the great war, just as the United States was affected by its Civil War. Therefore while every effort must be put forth to stabilize prices, extreme fluctuations must occur, as the outcome of the recent volcanic eruption in world affairs. Apart from such catastrophies, fluctuations in a modified way will take place as long as mother earth continues her fickleness in the matter of food production. The foregoing facts are stated in view of the many theories that are floating about as to how the affairs of the world "must be carried on" from this time forward.

Fortunately Canada has reason to have the fullest confidence in the sanity of its labour leaders. They are "from Missouri" and will want to satisfy themselves that their brethern are getting a fair share of the profits of their toil, and employers of labour who fail to accept that condition will wake up to the fact some day. In respect to the coal mining industry in Canada, for reasons referred to, it has on the whole been far from profitable. The operators have many difficulties yet to overcome. From the Fuel Controller's experience with the miners, he is confident they will always be prepared to take their share of any burden, provided the facts are made absolutely clear to them in a round-table conference, with all the cards on the boards.

In the reconstruction period which now faces us, one of the most complicated problems is the trend which the cost of living and the rate of wages will take, and their relationship to each other. While in several quarters the labour party has already stated its firm intention to contest a reduction in wages, the employers feel that in order to sell their products in competition with those of other countries, especially those of Europe, their costs of production, including the wages of the employees, must come down subject to the opinion previously stated respecting the upward movement of the standard of living. It is the Fuel Controller's opinion that wages must follow, not precede the cost of living downwards, and to that end all concerned should be shaping their policies. Here again there is need for the facts to be placed openly on the table. Few men are really unreasonable. It is the camouflaging of the facts that has made many unduly suspicious. The Fuel Controller believes that the Government should have available—and probably they are available—skilled technical men, to quickly determine whether the cost of living has gone upwards or downwards in any community, thereby justifying an upward or downward movement in wages.

Additional questions relating to labour of a more or less perplexing nature are peculiar to mining and to those other industries whose labourers are recruited from the newly arrived immigrants from foreign lands. Here we have the problem of making a useful citizen, often against his will, of a stranger in a strange land, in many cases with deep racial, national, and religious prejudices, and with warped, unhealthy ideas of government and the structure of society generally. Unless such a man is rapidly converted into a good self-

respecting citizen, to become an asset to the country, and a credit to himself, he will prove a mischievous if not a dangerous element in society. Consequently, they, too, should be surrounded with comfortable living and safe working conditions.

IV. DISTRIBUTION.

(A.) Transportation.

Since the transportation of coal is a relatively large factor in its ultimate cost to the consumer, the future trend of freight rates and railroad policies generally will have an important influence on the cost of fuel. With respect to the former, due to increased wages, high cost of materials, and properties more or less run down during the strenuous war period, there appear at present to be no factors tending to an early reduction. While the bringing about of lower rates will depend, to a large extent, on the general financial conditions prevailing in the future, yet a sound public policy with respect to the railroads, resulting in a maximum of efficiency, may assist in decreasing transportation charges.

In the United States, one of the most interesting and apparently most popular plans now before the American people, as a solution of present difficulties, is to divide the country into eight grand operating regions, each with two complete transportation systems. All of the railroads operating within a region would, under the proposed scheme, be linked up with one or the other of the two systems. Terminal facilities and other equipment would be allotted in the same manner. The project includes a financial reorganization whereby an issue of uniform stock and bonds, equal in the aggregate to the present outstanding obligations of the independent lines, will be substituted. The management and operation of the properties under this plan would be placed in the hands of a board chosen jointly by the shareholders and the Government. In this way it is hoped that the beneficial features of competition under private enterprise would be combined with the stabilizing influence of Government control, to ensure better service to the public.

With reference to the importation of coal by rail, one of our chief difficulties centres about the Niagara gateway. The situation in short is that, during the winter season especially, the Canadian railroads at this point are unable to accept freight in the quantity and at the rate at which it is delivered by the American roads. At the present time, in ordinary winter weather, the Canadian roads are not in a position to handle much over one hundred cars per day over this frontier. This is a serious matter especially to southwestern Ontario. which in view of the comparatively short haul from the Pennsylvania mines has depended in the past on all-rail coal rather than on the development of water facilities on lakes Erie and Ontario.

Approximately 42 per cent of all the coal imported into Canada is brought in by water routes, 46 per cent all rail, and 12 per cent by ferry—two points of entry on lake Ontario and four on lake Erie. In normal times water rates are much below railroad tariffs, the differential in favour of the former increasing in direct proportion to the length of the water haul. This is well illustrated by reference to the accompanying table, which indicates that the number of discharging plants increases with the distance from the mines.

Body of Water.	No. of Plants.	Storage Capacity.	Rate of discharge in Tons per Hour.
St. Lawrence	44	1,766,000	7,807
Lake Ontario	9	28,750	230
Lake Erie	3	5,500	310
Lake Huron and Gergian Bay	52	815,300	4,783
Lake Superior	11	2,792,000	3,580
Sault Ste. Marie	4	715,000	1,405
Totals	123	6,122,550	18,115

In the Maritime Provinces, much difficulty during the past two years has been experienced in securing anthracite by water from New York. In normal times the equipment of their ports is sufficient to handle the cargoes of small sailing vessels and barges; but in times of stress and emergency, when it might be desirable to handle boats of greater capacity, they are under present conditions unable to do so. As a matter of precaution against such periods it would seem advisable further to increase their dockage and unloading capacity.

In Ontario such cities as Toronto, Hamilton, and even Ottawa should eventually take in more coal by water. This would necessitate the construction of adequate unloading and storing facilities for which conditions would appear favourable.

(B.) TRADE AGENCIES AND LOCAL DISTRIBUTION.

An interesting feature of the production of anthracite is that the shortage in supply occurs periodically, largely due to abnormally cold winters. Theoretically there is a dividing line separating the anthracite-using territory from the southern part of the eastern portion of the United States, which does not need much fuel. That line is not fixed, but fluctuates northward and southward depending on the winter temperature. Some winters, as for example 1917–18, this dividing line was driven to the extreme south. This condition probably occurs only once in every fifteen years or so. In other words there is a large section of the country in the Central Atlantic States which draws a very moderate supply of anthracite from the mines in a temperate winter, but in the extremely cold winters, that occur periodically, their demand is very great indeed, resulting in the restriction of supplies to the more northerly territory, including Central Canada.

The distribution of coal does not differ materially from that of any other necessity of living. Inasmuch as it is bulky to handle, and also in view of the fact that its production is limited to definite restricted areas, it has always been distributed through regular trade channels, from producer to jobber and wholesaler, then to retailer, and ultimately to the consumer. In the case of some of the larger companies their product has been sold direct to the dealer through their own selling agents. In either case, the result is much the same as far as the consumer is concerned in view of the competition that exists within the trade. The average consumer, however, is interested mainly in the business of the retailer, with whom he has personal contact.

The public has always been most critical of the integrity of the coal dealer. The "coal baron" is a very common expression. There has been no real justification for looking upon the coal dealer with suspicion. The average coal

dealer is just as honest as the average man engaged in any other business. So far as the net profits are concerned, the Fuel Controller is of the opinion that those of the coal dealers in any community of Canada will be found to be considerably lower than the profits of practically any other line of business, when computed over a period of years. It is not here contended that his business is always conducted as efficiently as it might be; or even as efficiently as many other businesses are managed. But as long as the public continue to treat their fuel problem with the present indifference and refuse to co-operate with the dealer in solving the trouble, he is powerless to remedy the situation materially.

The question has frequently been asked—"why does it cost so much to deliver coal by the dealer?" It has been pointed out that coal may be delivered by the local drayman for a much smaller margin. The answer is that coal delivery in centres of population cannot be done by general carters; the country would freeze inside of a few days after winter sets in, if the public had to depend on cars of coal being shunted on side tracks in a railway yard, and their unloading left to local draymen. The dealer is compelled to have his yard and other facilities, including delivery equipment, and to maintain an office in order to provide fuel in the severe weather. The "Sankey Report" presented to Parliament 20th March, 1919, shows that coal selling at the mines in Derbyshire for 23 shillings and 5 pence ($5.65) per ton, cost the consumer in London—about 175 miles distant—44 shillings ($10.70) per ton, out of which the dealer received for handling, delivery and all other charges, including profit, 12 shillings and 6 pence ($2.98) per ton. The amount received by dealers in Canadian centres for a similar service ranged from $2.50 to $2.85 per ton. In rare instances it exceeded the latter figure, when the coal called for additional screening. Very little coal is consumed in Canada within 200 miles of the source of supply. For instance Ottawa is about 475 miles from the Pennsylvania anthracite fields.

The coal dealers' business even in normal times is fitful; he has to be prepared no matter how changeable the weather may be, and no matter how indifferent the public may be about ordering coal at the proper time. As a result there is here a burden which the consumers have to carry. The attitude of the public towards the coal dealer in the past has been that he must produce the coal whenever the consumer wants it. That attitude is unreasonable and economically unsound.

The key to the whole situation lies in the question of the proper time for the consumer to place his order for his winter's supply of coal. The only individual who can safely wait until fall to do this is one who lives in a mining district, and even in his case he is taking chances of running short. It cannot be impressed upon the Canadian public too strongly that the coal supply to the consumers of this country is primarily a question of transportation. All winters cannot be depended upon to be as mild as the past one; any winter may be a severe one, with its consequent demoralization, for short periods, of railway operation. The coal dealer is unable to forecast the weather conditions of the coming winter; and even if he could, in most cases his physical or financial facilities for storing coal are not sufficient for the entire winter requirement of all of his customers.

By ordering early the consumer not only assists the dealer in keeping down overhead charges by furnishing steady employment for his delivery machinery during the summer, but in this way the mines may be kept in operation the year round. This is a very important aspect of the fuel supply problem which the public does not appear to understand. It has already been pointed out that the nearer the operator gets to a uniform demand for the product of his mine throughout the year, the nearer he approaches the lowest possible cost

in production. So long as mines are forced to close down from time to time, through lack of orders, it means considerable added cost to each ton of coal extracted, and it is useless to discuss mining costs under such conditions. It is well known that many of the less fortunate in this world's goods are only able to purchase their fuel at the time they need it in the winter season. All the more reason why those who have the means, should get their supplies in during the summer, thereby enabling the dealer to properly look after the needs of the great number of small consumers, when the severe weather arrives.

A certain proportion of the people, varying in numbers in different communities, are in favour of the coal business being handled by the municipality. The stand they take is that since the municipality supplies water, why not the fuel? While this view may appear sound in theory, in actual practice, it is found, that there is a wide difference between the supply of water and fuel. With respect to the former the municipality under the guidance of technical experts, makes the necessary capital expenditure in the development of its water supply. It is not an annual commercial venture, like the purchasing of large supplies of fuel in a fluctuating market. While it is unsound to be changing the engineer of the pumping station from time to time, it has little bearing on the entire project. But with the city government changing continuously and possibly influencing or altering the control of the purchasing department, it would undoubtedly lead to losses. If, on the other hand, a municipal organization could be managed on the same basis as a commercial business, with a fixed policy over a period of years, there would be justification for adopting municipal control of the fuel business in larger centres, because in that event the coal yards could be distributed throughout the community at strategic intervals, and all made subservient to a uniform policy.

With an ample supply of coal in normal times, competition among existing companies assures the public of fairly adequate protection in the matter of prices, but with competition removed, it becomes another story. The production of Pennsylvania Anthracite is controlled by a few large and powerful corporations. The narrower the circle controlling any commodity becomes, the more aggressive is the controlling agency. This is but human nature. Therefore the Fuel Controller is of the opinion that it should be the function of some agency, on behalf of the public, to keep in touch with the activities of such corporations in the distribution of their supplies, not with the view of imposing hardships upon them, but to see that they take a proper interest in the distribution and sale of their product, down beyond the dealer to the ultimate consumer.

(c) COST ACCOUNTING.

To have fully and properly controlled the fuel business during the war period, it would have been necessary to have had all dealers enter the period with a proper system of cost accounting, in which the cost of each unit would have been shown. Small distributors of coal, of course, could not be expected to do very much book-keeping. If, however, the Cost of Living Branch of the Department of Labour had been in operation for some years with an ample staff of good examiners, and each coal company had been forced in pre-war days to bring their cost accounting into line with a standardized system, it would then have been quite possible to quickly detect excessive charges.

Experience, however, has led the Fuel Controller to the firm belief that the Cost of Living Branch should be enlarged, or some similar agency should be engaged in following very closely the activities, not only of coal but of various basic industries in the country. The aggressive business man is essential to the prosperity of a country but he can easily become too aggressive for the country's

good. While the law of supply and demand largely regulates prices, still critical periods will recur from time to time, when the weaker industries will be forced to the wall and labour employed by them consequently suffer. Under such conditions the more successful industries, in the hands of the aggressive men, frequently will take "all the law allows," and so far as the Fuel Controller's observation goes, occasionally without very much regard even for those whom they employ.

The tendency of such conditions is to centralize industry, whereas in the best interest of the country, as a whole, it should be distributed as far as practicable throughout the country. Therefore, the conclusion is inevitable that a well-organized branch of the Government service, compiling on standard forms the costs of each unit in the more important industries of the country, would soon expose to the weaker industries any high elements of cost in their enterprise, and knowing them, if unable to correct them, they should disappear from the country's business organization.

V. CONSUMPTION.

General

The public naturally is interested in a sufficiency of fuel at a minimum of cost, especially with reference to the domestic heating phase of the situation. Canada possesses soft coals, peat and wood, while it is anticipated that there are vast fields of undeveloped gas and oil. The Fuel Controller, therefore, feels it his duty to refer briefly to these various natural resources. It is not to be understood that it is being done in any thorough technical manner. There are various technical agencies in the service of the Government of Canada engaged in studying these questions, far better qualified than the Fuel Controller to discuss them.

Soft coal is the fuel which will in the future offer the greatest competition to anthracite. There is, however, much to be accomplished in the methods of using it for domestic heating, and many angles from which the question of fuel conservation might be approached. Among the phases which, from the present trend of investigation and thought, seem to offer the greatest promise of practical development, there might be named the question of improved furnace design, so as to obtain the maximum combustion; the establishment of central heating plants; the construction of by-product ovens, entailing an extended use of gas and coke; the fuller utilization of especially prepared fuel such as pulverized coal; and the perfecting of briquetting processes, especially with referemce to our western lignites. So far as central heating and by-product gas and coke are concerned, the reference to these is to give some idea of the respective methods, thereby indicating to the public that either one or other or both, may yet prove to be the means through which our own coals can largely take care of our own fuel needs. In other words, it may be said that the science of heating is to-day receiving a great deal of attention and the early future will have much in store for us in the matter of greater efficiency from our own supplies.

(A) CONSERVATION.

Conservation National

The conservation of coal is but one phase of a wider programme of national and international conservation dictated by necessity, if the solvency of the world is to be maintained. With the close of the war the need for conservation has apparently subsided. In reality, however, it is even more imperative if not so seemingly insistent than before. Canada, in common with other countries, stands on the threshold of an era which, it is freely predicted, will be characterized by the keenest kind of com-

petition. Canadian manufacturers will find themselves faced with competitors who have learned to cut costs to the minimum, and the Canadian people as a whole also will be brought into open competition with European countries in which frugality and economy have been watchwords for generations.

In the matter of coal, local markets will doubtless find themselves supplied with plentiful tonnages from time to time. At the present writing in fact many consumers both industrial and domestic are being circularized by companies, who are apparently in need of an outlet for their product. A closer study of underlying conditions, however, will serve to show that, in point of price at least, coal supplies are hardly likely to regain pre-war levels. Labour and transportation costs are high, as are also those for the materials that go into the development and maintainance of mines. It is well known too that both in anthracite and bituminous fields the period of the cheap exploitation of thick, clean seams is past. Added to previous costs in mining, therefore, there will hereafter be those occasioned by the more limited conditions imposed, by thinner seams, together with the necessity for additional labour in mining and preparing the product for market.

In Canada also we have an additional reason for investigating and applying, in as detailed and far reaching a manner as possible, every available method of coal conservation, for while the coal resources of the Dominion are large, the great bulk of her industrial activities lie within an "acute fuel area," and are dependent upon importations from the United States. Any waste of coal in this area is, therefore, a double waste in that not only has there been a failure in securing a maximum percentage of latent power from the coal itself, but the money paid for it—which runs into the millions annually—is sent out of the country. This is a matter of national importance. From the standpoint of individual industry also, coal has come to be a relatively larger part of the cost of the manufactured product, and it also features more prominently than ever before in the family budget. In spite of the fact, therefore, that the call for coal is not as voluble as throughout the period of war it will nevertheless be seen that conservation is an issue at once national, industrial and domestic.

Conservation—Industrial

The work of fuel conservation in industrial establishments is one of sustained attention to details. The factors that enter into an effective conservative programme, however, may be grouped under three general phrases. In the first place, there must be a scientific initial selection of the fuel with a view to the purpose and method of utilization. In the second place, the installation of mechanical equipment that will secure a high degree of combustion and a correspondingly high percentage of power utilization is requisite. Finally, the human factor must be considered. The fireman should be carefully selected and properly directed. It is not the intention here to definitely prescribe any classes of coal, types of apparatus or courses of instruction, but rather to emphasize the need for keeping abreast with the progress that is being made at present in each of these lines.

In the matter of selecting coals the percentages of carbon, volatile matter, sulphur, ash and moisture are variable factors whose relationships should be understood and analyzed, if purchases are to be made economically and efficiently. All is not gold that glitters, nor is everything burnable that is black, and purchasers of coal for industrial purposes will do well to seek, through scientific analysis for the highest ratio of heat units, and the lowest of sulphur and ash, consistent with the price paid. Coal conservation is not merely a matter of the price paid, but more essentially a matter of the percentage of utility secured.

In power-house equipment complete combustion should, of course, be a primary objective, and not less important is the problem of securing the trans-

mission and application of the highest possible percentage of power recoverable. In attaining these objectives, attention to details is the secret of economical operation, and an adequate system of records together with a proper system of inspection of both equipment and operation will be found invaluable. The production of a kilowatt-hour has been brought down in reasonably efficient power plants from four or five pounds of coal to less than two pounds, but this result has only been secured through economic, efficient installations, as well as a continuous study of details and painstaking supervision of operating conditions.

In the last analysis, the economies affected in an industrial establishment are in the hands of the individual employees. In the boiler room it is necessary for the fireman to see that the surface of the tubes are kept clean, that his boilers are guarded from drafts, that his steam pipes and valves are kept in repair, that ash and clinkers are kept out of his grates or fire pit, that firing is steady rather than intermittent, and that the body of the fire is kept undisturbed as far as possible on the part of the individual. These are things that call for constant attention, and they are the things that go to make up boiler-house economy. What is true of firemen in our industrial establishments applies similarly to firemen in our public buildings, schools and domestic establishments, as well as to those on railway locomotives. Conservation, in other words, depends upon individual training and attention to details. Those who would save fuel must learn, therefore, not only why conservation is now as never before imperative, but also how it can best be effected.

Conservation—Domestic

As national achievement is directly dependent on individual initiative, so is a country's conservation dependent on the personal economies effected by its citizens. Canada with its heavy war burden and scattered population cannot at this time afford to disregard the homely virtues of frugality. Canadians must learn also not only why to economize, but how. Saving must not be a matter of sentiment only, but also of science.

The brief study which the Fuel Control Organization has been able to give the matter of domestic fuel economy has but served to emphasize the need for a more extensive survey of the remedial measures necessary to secure for the country a more reasonable return on its annual outlay for domestic fuel. Present practice in the methods of attending to the firing of the individual furnace leaves much to be desired. Ignorance and indifference are the twin causes of the present unsatisfactory conditions existing, and it would seem that a considerable amount of educational work along these lines will have to be done to effect a betterment.

The scientific adjustment of draughts; damper control; the designing, construction and installation of furnaces and stoves; proper feeding and cleaning, on all these and other factors depends the conservation or the waste of fuel. Canada, moreover, is at times faced with periods of exceptional climatic severity and under present conditions her safety during such periods depends upon the successful shipment of adequate supplies of anthracite from a very limited field and across a highly congested transportation area to her consuming centres. Such a situation is not stragetically sound and indeed should not continue to be a standing risk.

The adaptation of our domestic heating apparatus to the utilization of soft coal would not only serve to carry the country through any period of anthracite fuel famine, but the greater use made of bituminous coal during Spring and Autumn weeks, and in the more temperate periods of winter, would mean a great reduction in our national coal bill. Experiments have recently been conducted, which give promise of very satisfactory results, in the matter of

designing domestic furnaces for the utilization of our raw lignites available in the west. Similar investigations would no doubt yield satisfactory results with respect to burning of bituminous coal in the east.

Then there is the matter of building specifications. Too little public attention has been paid in the past to the matter of proper home construction especially with a view to adequate and yet economical ventilation. With the Government entering largely into a programme of housing, an opportunity seems at hand to standardize types of heating and ventilation equipment. Some study has been given to this subject in the matter of school and public buildings, but a great deal remains to be done in the application of what is known of this subject to domestic building, and also in the work of encouraging and co-ordinating further research.

If the public thoroughly understood what a depressing effect the lack of the proper degree of humidity in the atmosphere has upon the human body; if they were brought to realize how dangerous even a slight amount of carbon dioxide is in its effect on the lungs; if they would study the matter of ventilation and air circulation as it applies to each individual home, so that the temperature on the floor will not be too cool for comfort, while nearer the ceiling it will not be unhealthily hot; then not only would the general average health of the nation be improved, a desirable event in itself, but a very decided saving would be effected in each individual's coal bill.

(B) CENTRAL HEATING PLANTS.

An inquiry has been made by officers of the Fuel Control organization, into the operation of central heating plants in various parts of the United States, with a view to ascertaining what progress has been made in this direction. There have been great advances made in general central-station services on this continent. They have developed from water and gas supply to telephone, electric light and power services. In some cities, central heating is already an accomplished fact and it is a plan which has many attractions.

Convenience

It is estimated that 400,000 people in Canada have to spend some time daily through the winter months shovelling anthracite into the family furnace. Under the central heating system this individual labour would be replaced by the mechanical handling of coal in large tonnages. The individual householder is put to the expense or trouble of firing his own heating apparatus and of disposing of the ashes. This phase of the question is enormously significant and looms up very large in the estimation of the consumer. The community service is obviously more convenient and this feature is important in itself.

Efficiency

Again, it is evident that in a central station well-designed and properly operated, there are great possibilities in the way of physical efficiency in the use of coal. Investigation to date would seem to indicate, that the average efficiency of the Canadian house-heating equipment does not exceed 50 per cent. In other words, half of the heat value of the coal is lost " up the chinmey " in converting it into applied heat. On the other hand, a modern heating plant, in charge of an experienced stoker, should reach an efficiency of 70 per cent. We have here, apparently, an advantage of 20 per cent in favour of the central system.

Line Loss

Against this there must be placed the inevitable loss involved in the transmission of the heat to its ultimate destination, technically called the "line loss." The extent of this loss is difficult to estimate, owing to the different conditions prevailing in connection with central heating projects. One important factor is necessarily the distance

of the average consumer from the central plant. Investigations by the United States Bureau of Mines indicate that the "line loss" is between 4 and 12 per cent of the heat generated.

Even with this deduction, there is still a clear advantage in favour of the central system.

General Considerations

The central plant ensures regularity and uniformity in temperature, as it would be fired day and night. It eliminates the individual cost of tending furnace, also the necessity of an individual furnace, and this would tend to reduce the cost of house-construction.

The criticism may be made that while admitting that improved fuel efficiency can be attained by this method, the central plant generally would be run for profit and that the saving would be largely or wholly absorbed in paying overhead and profits to the central organization. There are, however, other considerations which must be taken into account.

Saving in Cost of Fuel

Anthracite coal is almost invariably the domestic fuel in the towns and cities of a large portion of Canada. Because o its cleanliness and convenience of firing, anthracite readily commands a much higher price than bituminous coal. This increased price is quite out of proportion to the increased fuel value of the anthracite, which is inconsiderable and may be almost wholly ignored for practical purposes. The public pays the increased price for anthracite simply to escape the dirt and inconvenience incidental to using bituminous coal.

It is a peculiar fact, bearing on this phase of the question, that the greatest development of the central heating system in the United States is precisely in districts where coal is cheapest, such as in the States of Pennsylvania, Ohio, Indiana and Illinois. One would have expected that the most promising field for central heating would be in the districts where coal was dearest and where the economy effected consequently would be largest.

Coming to a consideration of the relative cost of burning anthracite in the individual equipment and that of burning bituminous coal in the central heating plant, we find that the average cost of anthracite coal was $2.89 a ton higher than bituminous coal. This figure has been reached by analyzing the customs valuations at the mines of all classes of coal imported into Canada during a period of twenty years with the following result:—

Average cost of anthracite coal	$4 77 a ton
Average cost of bituminous coal, including steam sizes	1 88 a ton
Saving by use of bituminous	$2 89 a ton

Cost of transportation to the ultimate destination must of course be added in both cases and would be approximately the same for either class of coal.

Granting that the Fuel value is practically equal, it will thus be seen that a saving in cost of fuel amounting to practically 60 per cent may be effected where conditions permit of introducing the central heating plan.

Economy in Handling

Nor is this the whole story. A central heating plant would necessarily be located on a spur track connected with railway facilities and would purchase its coal in car-load lots, unloading directly from the car into the boiler-house. Only a trifling expense would be involved in handling. The individual consumer, on the other hand, uses anthracite coal purchased by retail and delivered in his basement.

Careful investigation has been made by our statistical branch into coal handling all over Canada, and it was found that throughout 1918 the average

cost of handling anthracite in the provinces of Ontario and Quebec approximated $2.25 per net ton, to which add the excess of cost of anthracite f.o.b. station over bituminous, say $2.75, making a total estimated saving of $5 per ton. From this would have to be subtracted the cost of handling bituminous coal into a central heating plant, say $1 per ton. These figures are given more to draw attention to the possibilities of saving through central plants and the necessity of that system receiving serious consideration by our Canadian municipalities and Provincial Governments.

There would appear to be a particularly favourable field for central heating in the smaller communities in Western Canada, and also in the eastern part of the country where power is generated in steam plants. Most of the central heating systems in the United States are being operated under such conditions, the exhaust steam being employed for heating purposes.

Use of Power Plants

Where the heating load is large enough to entirely submerge the power load, there will be no peaks in the boiler room through variations in the latter. When the engines are exhausting their maximum into the heating system, the regulating valves will automatically cut the supply of live steam to the required amount; when the power load is a minimum, they will open and supply live steam to meet the requirements.

During the winter season the electrical energy generated is regarded as a by-product, and during the summer season all the fuel is chargeable against the electric service. Compound condensing engines are used when no heating is required.

The same boiler capacity that will produce electrical energy for lighting three to four blocks in cities of medium size will supply exhaust steam in sufficient quantity to heat at least one block. This enables the system to take on a suitable heating load within easy distance of the generating plant, without increasing the boiler capacity. This is, of course, the most economical arrangement from the point of view of operating cost. The steam, after it has passed the engines, will do nearly as much heating as it would before, and the power generated may vary from zero to maximum with only a very small increase in fuel requirements.

According to a survey made by the Dominion Water Power Branch, there is generated in Canada, in connection with central electric light and power plants operated by steam, a total of 192,110 horse-power. Such being the case, it would appear that there should be a fairly favourable field for utilizing exhaust steam for central heating purposes. Municipalities and utility corporations might advantageously give attention to this matter in the general interest of fuel conservation.

United States Developments

To convey an idea of the extent to which central heating plants are being operated in the United States, it might be mentioned that in the State of Illinois alone there are 45 such plants operated by private enterprise, in addition to those owned by the various municipalities. Rates in the case of the former are under the absolute control of the State Public Utilities Commission. Large plants are also in operation in the western cities of Spokane and Seattle.

In Canada a start has been made in the city of Brandon, Manitoba, where a central heating plant is operated by a utilities company; and in Toronto some apartment houses are similarly heated.

Summary Improvement in the efficiency of the application of heat is a matter to which heating engineers have devoted considerable attention, and some of the results obtained are indicated in the foregoing data. The greater efficiency and convenience of the central heating system have been demonstrated, and also the saving in the cost of fuel and the economy in handling coal.

The fact, however, must be admitted that difficulties exist in respect to the use of this method of heating. Much depends upon the density of population in a community and the distances to be overcome. The science of heating is at the present time in a condition of flux, and if has seemed timely to indicate the trend of activities by experts who are working on this subject. One cannot but be impressed with the tremendous saving which could be attained by the mechanical distribution of coal in large tonnages as compared to the individual labour of handling it in small lots, and it would appear that science is gradually working towards a solution in that direction.

(c) BY-PRODUCT PLANTS.

The present-day tendency is distinctly away from the use of raw coal for heating and power purposes. The most extensive and promising field in this line is apparently that of manufacturing the raw coal into coke and various other by-products, by the use of the modern by-product oven. This matter is of such importance that a report was obtained thereon from Warren S. Blauvelt, of Detroit, a leading authority on the subject in the United States. Through the courtesy of the Dominion Steel Company, the services of F. E. Lucas, of Sydney, N.S., were made available for the Fuel Control organization for a short period. Mr. Lucas likewise stands very high in his profession, and his report goes into the subject in considerable detail. Both of these reports appear in the appendices and are worthy of the most careful consideration. It will be observed that Mr. Blauvelt advances the unique suggestion that gas distribution systems should be regarded in the same light as highways—to be controlled by the municipality. His views seem to be that the municipality should not engage in manufacturing or merchandizing, but should provide the necessary highways whereby both are made possible.

(d) PULVERIZED COAL.

In the conservation of fuel any process that ensures a more complete utilization of the mined coal is worthy of close consideration. The method of using coal in pulverized form comes within this category, for by its use low grade coals, hitherto considered too poor to burn, may not only be burned, but burned with satisfactory steam producing results. This becomes possible mainly through the fact that the fireman is able to maintain at will any desired length of flame and any amount or type of combustion necessary with the particular design of furnace.

The combustion of powdered fuel is in reality a reaction between solid fuel and oxygen. The velocity and completeness of this reaction depends on:

(1) The surface exposed by the solid. Whereas a cube of coal one inch thick has a surface exposure of only six square inches, by grinding,

this is increased to approximately 1,800 square inches, or, in other words, the surface exposure has increased 300 times, thereby increasing the combustion three hundred fold.

(2) The pressure of reacting gas. By maintaining proper velocity of air current, fuel is carried into the furnace in suspension, and there burned completely, rapidly, and efficiently.

(3) The intimacy of the mixture of solid and oxygen. In the case of powdering, the fuel is so fine that it is possible for each small particle to be surrounded by the proper amount of air, hence an intimate mixture.

The greatest problem which the fuel engineers have had to solve was that of mixing the powdered coal with the correct amount of air, which, of course, had to be done by mechanical means. Improvements are constantly being made in this direction.

Use of Pulverized Coal

The use of pulverized coal is becoming more and more extended in the United States, and to some extent in Canada. The pioneer work in connection with pulverized coal was in the Portland Cement plants, which led to increased recognition, and was the means of bringing the pulverizing machines up to their present high state of development. In these operations, not only is the coal pulverized, but the raw material also, such as limestone shale or cement rock; as well as clinker produced by the kilns. In the manufacture of steel, 2,000,000 tons of pulverized coal are being used annually for all kinds of furnaces, *e.g.*, open hearth, heating, puddling, soaking pits, continuous heating, reheating, annealing, forging furnaces, etc.

The copper industry also has claimed the use of pulverized fuel, the figures showing an annual tonnage consumed of from one to two million. Worthy of note is its application to rotary kiln for the disulphuring and roasting of various grades of ore and also nodulizing flue dust so as to make available certain products heretofore rather expensive to recover. It is also being used in the making of oxide of lime for use in open-hearth furnaces and for burning; also for dolomite to replace magnesite used for furnace linings.

The progress in the development and use of pulverized coal has been rapid and most encouraging. Up to a few years ago it was thought that only coals carrying no more than 2 or 3 per cent moisture and at least 25 to 30 per cent volatile combustible matter could be used in a pulverized state. Further developments, however, have shown that pulverized coal carrying 4 to 5 per cent of moisture and as low as 10 per cent volatile combustible matter can be utilized. It, therefore, seems that developments in the use of this fuel within the near future are likely to be extensive.

Pulverization of Western Canada Coals

If the general use of pulverized coal proves successful, it will be of incalculable value to Western Canada. Along the foot-hills of the Rocky mountains are immense bodies of crushed coal, so crushed that it is an expensive matter to readily handle and burn it under the conditions now prevailing. These coals run extremely low in moisture, many of them less than 1 per cent, and are very high in fixed carbon. The volatile combustible matter, however, is low, but it is probably sufficiently high for the purpose. In any event, a small addition of coals, high in volatile combustible matter, would, no doubt, surmount any difficulty in the way. Mixing ordinary coals so thoroughly as is necessary, is not an easy matter, but when pulverized, the mixing can be much more thoroughly and economically done than when in the lump or run-of-mine state.

The development of this industry has already sufficiently advanced to leave little doubt of its ultimate success. Already in Seattle, Vancouver and other points along the Pacific Coast, installations of the plants necessary to utilize this fuel have been made. One has been installed at Seattle costing about $500,000. Equipment is also being installed for smaller plants in these cities and it seems to lend itself particularly favourable to house-heating purposes, especially where the building or block is of considerable size. The residue of ashes, therefrom, is almost nil; and its combustion is free from smoke—in fact, pulverized coal gives out very little more smoke than does gas or oil.

As Railway Fuel

As to the use of pulverized fuel by railroads, the *Engineering Journal* says: "Steam locomotives will eventually have to be equipped so as to approximate to electric machines by the use of pulverized fuel, which in time, will eliminate smoke, soot, cinders, sparks, and fire hazard; reduce noise, bring down the time for dispatching at terminals, and standby losses, and increase the daily mileage by providing for longer runs and more nearly continuous service between general repair periods."

Transportation

One of the chief objections raised to the general use of pulverized coal, is that special tank cars will be required for the transportation of this fuel, and cylinders for the storage. The tank car, however, will not cost very much, if anything, more than the special steel car now used largely for the transportation of coal. And as to the question of storage, when coupled with automatic feeding of pulverized coal into the boilers and the fact that such fuel lends itself admirably to cheap handling in transference from the cars into storage, it probably will prove more economical than ordinary coals, in regard to storage and handling. A further objection has been raised that these cars can be used only for this purpose. In answer to that it is probably safe to assert that "one-way freight" applies to 80 per cent of the coals now transported. In fact, one would probably be within the mark in placing it at 90 per cent.

If the low-grade lignites of Saskatchewan and portions of Alberta did not contain so much moisture, the utilization of them as pulverized fuel would readily solve many of the obstacles in connection with their use. They are very high in volatile combustible matter. Experiments made for locomotive purposes on a mixture of high-grade bituminous crushed coal of Alberta with crushed coal from Bienfait, Sask., demonstrated that using them in the pulverized state so mixed, gave a very much higher percentage increase in resultant energy than it did with either of them when used separately. And it may be that those lignites, when even only air-dried and mixed with an equal portion of the crushed bituminous coals alluded to, will make an ideal fuel.

The fuel required for houses heated by other than ordinary stoves throughout the country, probably amounts to 50 per cent of the total fuel requirements. If central heating plants should prove feasible on any considerable scale, pulverized fuel seems particularly fitted for that purpose.

(E) BRIQUETTING OF COAL AND LIGNITES.

The whole question of the briquetting of coal is receiving very serious attention at the present moment, not alone in Canada, but also in the United States. In the Pennsylvania anthracite fields and also in connection with bituminous operations, there are vast accumulations of waste coal so fine in size that it has, in the past, been considered practically unsaleable. The fuel value is, of course, present, but the combustion is so difficult that sales of such a product have hitherto been regarded as practically impossible. The vast heaps

of this material now disfiguring the American anthracite fields while not in available form, actually represent a great national asset. Step by step it has become necessary to practice more rigorous economy in anthracite mining. Formerly, it was a common practice to sacrifice utterly a thin seam of coal lying above a thick one in order to secure the product quickly and cheaply. The growing demand for the conservation of the resources of all countries is calling for the most rigid economy and utilization of all the available products and by-products of the mines. Special attention is now being paid to the problem of profitably briquetting this accumulated waste coal.

The Technical Aspects of the Problem

In discussing the experimentation on this subject by the Lehigh Coal and Naviagtion Co., the " Retail Coal Man ", in a recent article sums the problem up as follows:—

" . . . where others have confined themselves to laboratory experiment and occasional investigation the mines of the famous Old Company Lehigh have, since 1909, been actively at work to demonstrate the commercial value of the fuel briquet.

"For a while their plant at Lansford turned out briquettes using the European pitch system. They were, however, keenly alive to the possibilities of improvement and continuously worked on the three great briquetting problems:—

1. The binder problem.
2. The preparation problem.
3. The press problem.

"For the present, at least, it is admitted that the making of briquettes without some binding material is practically out of the question. Consequently, there has been a continual stream of patent applications covering the manufacture and use of a list of materials suitable for the binding of the coal particles together. The binder must fulfill three requirements. It should produce a briquette that is waterproof and weather-proof. It should contain as little as possible of undesirable combustion products, such as smoke and gas. It must be low in price. Nearly all the so-called patented binders fail on one or more of these requirements. The preparation problem is one whose importance has only recently come to light. By preparation is meant the proper mingling and intermixing of the coal and binder. Heretofore, ordinary paddle mixing was considered sufficient, the results being low efficiency on the part of the binder. It is now conceded that in order to cut down costs, it is necessary that a very definite and complete mastication take place before the coal binder mixture is ready for the press. It will suffice to say that the press adopted has been of the rotary type, consisting in effect of turn cylinders with molds cut into the exterior pressing against each other in their rotation . . . . "

Briquetting of Coal

The briquetting of waste coal in Canada is not yet an issue of immediate importance. The only plant now in operation is in connection with the Bankhead Mines in Alberta, where a semi-anthracite coal, very much broken up, is mined. The operations there have been on a very modest scale. In 1913 the sales were 130,968 tons; in 1914, 108,918 tons; in 1915, only 83,096 tons and in 1916, 107,959 tons.

Briquetting of Lignites

The problem of utilizing profitably the enormous deposits of lignites in Alberta and Saskatchewan has for some years engaged the serious attention of various Government agencies. Valuable reports have been issued on the subject by the Honorary Advisory Council for Scientific and Industrial Research, and also by the Commission of

Conservation. Contributions have also been made by the technical staff of the Department of Mines in various official reports. These publications contain about everything known to date on the subject, and such being the case no lengthy comment thereon is necessary.

At the instance of the Sub-committee of the Privy Council for Scientific and Industrial Research, a board was formed, under the auspices of the Honorary Advisory Council, and under the chairmanship of R. A. Ross, E.E., to investigate the whole subject and to arrange, in conjunction with the prairie provinces, for the erection of an experimental plant to test out the problem on a practical basis. This work is now proceeding and, it is hoped, will meet with successful results.

VI. RECAPITULATION AND RECOMMENDATIONS.

The fire loss in Canada for 1918 amounted to $30,000,000, or about $4 per capita, whereas in England the figure is about $0.64. Carelessness has much to do with this vast amount of wealth being sent up in smoke. The Commission of Conservation in a recent report debited 70 per cent of the entire loss to this cause. Great, however, as is the loss by fire, it cannot be compared with the loss of heat and energy in the domestic and industrial use of coal, which it is safe to say is more than double that lost through conflagration, or over $60,000,000 spent annually by Canada, in return for which absolutely no value is obtained. From this it is clear that the fuel question is one of serious concern to each and every individual in the country, and the science of obtaining the greatest efficiency out of the various classes of fuel is worthy of the most thorough investigation by the best available technical minds.

The consumer of hard coal in central Canada—Ontario and Quebec—might as well realize that the anthracite producing district is practically confined to the State of Pennsylvania; that any disturbance in any section of the field will immediately affect the whole district, which in turn affects the entire market. Furthermore, 72 per cent of the total anthracite mined is produced by eight powerful corporations, and if any of them should at any time see fit to become arbitrary, it would cause, at the least, serious inconvenience to the market. As a matter of fact the anthracite market has been very seriously disturbed from time to time through labour troubles, and especially through the abnormal demands for this class of fuel, during those extremely cold winters, that occur every fifteen or twenty years.

Owing to the adverse conditions surrounding anthracite supplies, central Canada is far too cold a country to depend upon it alone. Periods of trouble have arisen in the past with respect to anthracite supplies, and under existing conditions the only safeguard remaining to Ontario and Quebec is to be able to turn to the use of soft coal to carry them through periods of emergency. If the war had continued through the past winter, and if it had been moderately severe, the Fuel Controller fears there would have been actual suffering, simply because it seemed to have been impossible to impress upon the public the necessity of using soft coal, of which an ample supply was guaranteed to Canada by the United States Fuel Administration. The trade was not favourable to its use; the cry was that the smoke flues are not sufficiently large for the use of soft coal; and that the flues in the chimneys are too small. In these objections, unfortunately, there is a good deal of truth, though a great many consumers could use soft coal in an emergency. The anthracite producers and dealers are naturally opposed to an invasion of their market, through the use of soft coal. The fields producing this latter fuel are so widely distributed, and there is such an abundance of it, that its market cannot be controlled by trade agencies, as is possible with anthracite supplies.

The dealer in anthracite has naturally been keen to get the agency of one of the large corporations, because it has meant an assured business. The big producing corporations can become quite arbitrary with the dealer, but who is there to see that that aggressiveness does not reach the point of being unfair. The Fuel Controller is of the opinion that it should be the function of some agency, in each of the two leading anthracite-consuming provinces, for a few years at least, to keep in touch with the entire situation, especially in view of conditions now surrounding anthracite production.

The eastern and western portions of Canada, largely depending upon domestic coal, also have their fuel problems. Generally speaking the cost of production of coal in Canada has been excessive. If that statement is correct, then the development of industry depending upon local fuels, is being impeded. The situation is certainly worthy of investigation. It is the opinion of the Fuel Controller that a careful survey of the various coal fields throughout the Dominion should be made by say three engineering operators—one representing the Dominion Department of Mines, another the Department of Mines of the province in which the investigation is being conducted, and the third, one familiar with methods of mining and costs in the larger field, where mining is being done at the minimum of cost, as, for instance, the Pittsburg district in Pennsylvania.

The production of coal in an economical and efficient way is only one aspect of the situation. Securing the maximum of heat and power is no less important. A considerable amount of investigatory work is being carried on with this latter end in view. Canada's coal bill has become so vast that the people of necessity must have the maximum of heat and energy for the minimum of cost. Much can be done by the consumer of fuel, through conserving it, by an intelligent heating of the house without trying as well to moderate the temperature of the atmosphere surrounding it. The problem is, however, of such outstanding importance to the people of Canada as a whole, that some group of men should be following it very closely and in an aggressive manner, in order:—

1. to obtain from existing methods in the use of fuels the greatest possible efficiency;

2. to follow new methods closely from which it is at present anticipated much will be accomplished.

With regard to the first, it would seem sound to suggest that furnace men should be instructed in the use of coal in furnaces. It is a very old saying that "there are two ways to do everything," and very frequently the wrong one is followed. There is quite an army of individuals in Canada engaged in feeding furnaces in winter. Classes might profitably be held in various centres throughout the country, and demonstrations given as to proper methods of firing coal. Municipal authorities doubtless would gladly make all the arrangements for having furnace men attend such classes, provided some governmental agency supplied the technical instructors.

The manufacturers of furnaces should be canvassed, with the object of having them adapt their various types of furnaces to the use of soft coal, not only when an emergency makes it necessary, but when circumstances make it desirable. Likewise municipalities should be approached so as to have plans of proposed residences inspected by some provincial officer with the object of adopting types of construction with suitable air space in the walls, so as to ensure greater protection against inclement weather than is frequently aimed at. It certainly appears as though insufficient attention, in a public way, is paid to the construction of ordinary residences in Canada, necessary to withstand severe winters.

The development in central heating plants should be followed, as well as the progress that is being made in the production of gas and coke by re-product ovens; in the briquetting of coal and in the use of powdered fuel. Considerable concern has frequently been expressed by Canadians respecting the dependence of Ontario and Quebec on the United States for their fuel. As previously pointed out the Fuel Controller does not share in that concern, from any fear that Canada would be denied its supplies. It is, however, a sound national policy to use, as far as possible, the country's own natural resources. The suggestion has been advanced that the needs of central Canada can, if necessary, be taken care of by the use of our domestic bituminous coal from the Maritime Provinces. The whole question is one of such vital importance to the Canadian people that it should not be allowed to drift, depending solely on local initiative in this or that city, but in the opinion of the Fuel Controller the best available engineers should be employed by the country, in a consultative capacity; men who are making a study of heating equipment along the most modern lines, and whose function would be to advise when and where certain methods were capable of practical application to the various centres of Canada. A leading consulting engineer who specializes in one line of activity, as, for instance, by-product ovens, could not be taken into the Government service, because the Government does not pay salaries that will enable it to obtain such men. The Fuel Controller believes that equally good results could be obtained by giving them modest retainers, and have them attached in an advisory way to some branch of the Government service. It is that type of technical man that it is suggested should be employed in a consultative capacity.

The Fuel Controller has in a brief way endeavoured to make it clear:—

(1) That mining conditions in Canada, under an arrangement with the interested provinces, should be looked into, in connection with:—

(*a*) Methods of mining
(*b*) Wasteful extraction of coal
(*c*) Costs of production
(*d*) Over-capitalization.

(2) That at least imported coal supplies for a reasonable period following the declaration of peace, might very properly be closely watched by some one familiar with United States mining conditions, so that in the event of unusual happenings likely to affect supplies, no time would be lost in apprising all interested consumers in this country.

(3) That mining operators should be called upon to submit confidential statements at stated times to the Government showing in detail costs of production, on approved forms. In fact, some accounting agency should be assigned to follow, not only the activities of the coal trade, but other basic industries, with a view to standardizing methods of accounting and business practices and eliminating what, in the case of some concerns, is blindfolded business effort in fields where fundamental conditions are against them, entailing ultimate loss both to the firms so engaged and to the country at large.

(4) That efforts should be made to increase the efficiency of the present methods of utilizing coal.

(5) That the development of new methods of domestic heating, and the production of power, should be actively followed, and tentative plans advanced by competent consulting engineers for the location of plants, either central-heating, or by-product gas plants, or both.

Should any or all of the foregoing suggestions be approved, the question at once arises, as to what agency is to be entrusted with the work. The problems are very largely of a character that require treatment by highly qualified technical men. The Fuel Controller takes the liberty to suggest that as the Honorary Advisory Council for Scientific and Industrial Research deals with technical problems, that this report be transmitted to them for consideration and recommendation as to the best method for dealing with the problems enumerated on a scientific and permanent basis.

(A)

ECONOMIC UTILIZATION OF FUELS.

USE OF GAS AND COKE FROM BY-PRODUCT OVENS.

By Warren S. Blauvelt.

To give adequate answers to many questions as to the best sources and methods for supplying the fuel needs of the Dominion of Canada during the next few years is impossible in the present state of the art of economic utilization of fuels. There are, however, certain processes commercially developed which are of immediate value; their more general adoption would be of material economic value and would result in better service at less cost to the general public, than methods generally used. In addition there are being developed other processes which give promise of ultimate success in the near future, which will make possible the utilization of low-grade fuels, securing therefrom values which are lost when the raw fuel is burned direct; these processes will, when commercially developed, reduce transportation charges materially, provide cheaper gas, a satisfactory smokeless fuel at a lower cost than anthracite, and will be an important factor in providing liquid fuels for use in automobiles, tractors, etc., and for various industries.

In 1881, Sir William Siemens said: "I am bold enough to go so far as to say that raw coal should not be used for any purpose whatsoever, and that the first step toward the judicious and economic production of heat is the gas retort, or gas producer, in which coal is converted either entirely into gas or into gas and coke."

Modern Developments

The increase in freight rates and in royalties on coal, the growing demand for liquid fuel and the desirability of increasing the supply of fixed nitrogen for fertilizing use, make it more profitable to carry this suggestion into practice than when it was made nearly forty years ago. The demand for coal by-products has increased enormously; the by-product coke-oven process has been brought to a relatively high efficiency, the gas producer has been greatly improved, highly efficient gas furnaces have been developed, and briquetting processes have been worked out successfully for many kinds of fuel. Public opinion is also growing in favour of a national control of fuel resources which will prevent undue waste, reserve for important industries the special kinds of fuel which appear essential for their operation, and in cities prohibit the needless fouling of the atmosphere with smoke and soot.

Methods

There is no one method of solving so vast a problem. A variety of methods and of combinations of methods will doubtless be required, depending upon the kinds of raw fuel available and the uses to which it is to be put. Where a reasonably satisfactory coking coal is obtainable and the demand for metallurgical coke exists, by-product ovens should be used to produce the coke and gas for distribution to towns and cities within about fifty miles thereof, where the gas requirements would justify the pipe lines. To provide for variation in demands for gas, the ovens should be equipped to be fired with producer gas or oven gas at will; this makes it possible to vary the output of oven gas from about 5,000 to about 10,000 cubic feet of gas per ton of coal coked.

Domestic Use of Coke

The small coke made at such an operation may be used as a domestic fuel in place of anthracite; in most locations it can be sold profitably at a considerably lower price than anthracite. That properly prepared by-product coke is a desirable domestic fuel is clearly shown by the steady increase in its consumption for such use. In the Detroit

district annual sales of prepared sizes of by-product coke increased in six years from about 45,000 tons to about 250,000 tons. To insure the utmost satisfaction to consumers it is desirable that the fire pots of furnaces or stoves should be somewhat larger than are necessary for anthracite. The burning of a pound of coke of the quality commonly made from low ash coal, generates more heat units than are obtained from a pound of anthracite, but its lower density requires a greater bulk to be consumed to give the same heating results; hence either larger fire pots or more frequent firings are necessary.

The small coke may also be used to advantage in making producer gas for industrial use or for distribution for house heating in congested districts.

Use of Gas

For house heating in many closely built cities, unquestionably gas could be used more economically than raw coal, all things considered.

To get the full benefit of the possibilities of fuel gas in cities, however, some radical changes in the conditions governing the financing of gas distribution systems are essential. When the public provides a free highway for the distribution of gas as is provided for the distribution of coal in wagons, the heaviest handicap on the more general use of gas will have been removed.

There are in general three kinds of manufactured gas which may be distributed economically under suitable conditions: Coal gas, having a calorific power ordinarily from 550 to 600 B.T.U.'s per cubic foot; blue water gas, having a calorific power of approximately 300 B.T.U.'s per cubic foot; and producer gas, having a calorific power which may vary from 125 to 175 B.T.U.'s per cubic foot, depending upon the kind of fuel employed. Where ordinary coal gas is to be used alone, the quantity available most economically will be limited by the market requirements for the coke produced in the retorts. Hence such gas cannot, in most places, be produced economically in sufficient quantities to meet the full possible demands for heating if gas were to be substituted for solid fuel. There are exceptions, of course, where the iron and steel industry consumes very large tonnages of coke.

In the iron and steel industry ordinarily the surplus gas from the coke ovens is used in the steel mills. From a national economic point of view this is not justifiable, if this gas could have a higher use in general distribution in nearby cities. Producer gas might better be employed for the steel mill and the higher calorific power gas be distributed over the wider areas. This would coordinate the public service with the iron and steel industry in such a way as to insure a more regular operation of the iron and steel industry and a reduction in the price fluctuations of iron and steel, due to the fact that larger stocks of pig iron would be carried through periods of depression, as the plant would operate through such times in order to keep up the city gas supply.

As coke is used to make water gas, it is obvious that in a district where coke ovens produce more coke than is needed, but where the demand for gas exceeds the gas output of the ovens, water gas made from coke should be used to make the proper balance.

By-products from Western Canada Coals.

The experimental work now going on in the distillation of the relatively low-grade coals at low temperatures, promises results of vast economic importance. Such coals, with which Canada is well supplied in the West, yield by these processes a high-grade smokeless fuel which will not deteriorate in storage. This one feature is in itself of great value as it makes possible all year round operation of coal mines and transportation systems at a uniform rate. These processes yield comparatively little gas, but they do yield large quantities of liquid condensate, from 20 to 30 gallons being obtained per ton of coal, depending upon the quality of coal and the temperature

of distillation. This oil equals petroleum in heating value. By subjecting it to cracking processes, from 25 to 40 per cent, or even more, it may be converted into fuel suitable for automobile engines. The solid residue contains the greater part of the nitrogen originally carried by the coal. This residue may be completely gasified in gas producers and much of the nitrogen may be recovered in the form of ammonium sulphate. Apparently as a producer fuel it would be a pronounced success and the recovery of the ammonia would in many cases undoubtedly prove highly profitable. Probably some combination of low-temperature distillation with by-product producers will prove ultimately the best way to utilize many of the high volatile coals found from Manitoba to the Pacific.

Some of the coals in this Western section may not prove well fitted for this particular treatment. In such cases it may prove desirable to briquette the residue after driving off the heavier volatile matter at low temperature. The briquettes would then be available for general distribution or for use in gas producers.

The Ontario Situation.

The fuel demands of Ontario can probably for many years be supplied most economically by high-grade bituminous coal purchased in the United States. For metallurgical use additional by-product oven plants should be installed. The gas and small coke produced therein should be used to replace anthracite; and some of the coke might be used advantageously in the manufacture of water gas and producer gas for house heating and industrial use.

Meanwhile, active research and experimental work to render profitably available the peat resources of Ontario should be supported. The development of satisfactory processes for briquetting peat, for gasifying it with the recovery of by-products, and for distilling it in by-product ovens will ultimately be accomplished. The benefits to be gained therefrom warrant the expenditures involved for the commercial development of such processes.

Railway Requirements.

The Dominion is singularly fortunate in the plentiful supply of water-power; except for locomotive use, the consumption of coal for power generation is comparatively small. Presumably the electrification of the railways will be undertaken in the not distant future. Where water-powers are nor available it is probable the fuel for locomotives will ultimately be briquettes made from lignite or peat, or semi-coke made in the partial distillation of high volatile coals at low temperatures. For stationary use, gas from by-product producers will probably be found economical in some sections.

Government Investigation Recommended.

In this report it is impossible to speak in other than most general terms of the possibilities and of the lines of investigation which promise the most valuable results. The matter is of such importance not only for the present, but for years to come, that it would seem highly desirable from a national point of view for the Dominion Government to make provision for an exhaustive investigation of this whole subject, providing facilities for research and for experimental work on the different kinds of fuel.

In this work it would be desirable to secure the co-operation of the United States Bureau of Mines and of those states, notably North Dakota, which are working along similar lines. Each country should gain the benefits of research work on every kind of fuel tested by the other, and arrangement might well be made to avoid duplication of experiments. The problems of the best methods of utilizing peat, lignite, and semi-bituminous coal on both sides of the international boundary, are similar. The joining of efforts for the public service in this way would not only save money. but would also be of value in further cementing the cordial relations happily existing between the two countries.

As pointed out previously, not only are there some technical difficulties to be overcome to secure the best results from the fuel available, but there are politico-economic difficulties which prevent gas from being distributed as economically as it should be in order to secure the best results. When the solving of such problems is left entirely to private initiative, the effort necessarily must be made to solve the problem in the manner which promises the utmost profit under the conditions established by law. Looked at from a broader view-point, it is the function of wise statesmanship to remove all legal obstacles which make it unprofitable to secure the highest possible service in the consumption of the fuel resources of the country.

In the United States, and probably to some extent in Canada, the conditions established by law made it less profitable during the years preceding the war, to produce bituminous coal for the general market, than to speculate in undeveloped coal lands. Also it was in many cases unprofitable to recover all of the coal that could be taken from a mine, and many mines containing much recoverable coal have been destroyed. The distribution of gas has also been heavily handicapped by the high capital charges on the gas distribution systems, and by the burden of taxation thereon. I would, therefore, strongly recommend that a thorough investigation be made of the legal environment of the entire fuel industry; also that recommendations be made following such investigation, for such changes as may be necessary in Canadian laws to make the most economic utilization of the country's fuel resources more profitable, and all wasteful methods unprofitable.

WARREN S. BLAUVELT,
Consulting Engineer.

DETROIT, February 10, 1919.

(B)

THE COAL RESOURCES OF CANADA.—THEIR RELATION TO THE INDUSTRIAL DEVELOPMENT OF THE COUNTRY.

By F. E. Lucas.

I take it first that it is desirable that Canada should conserve her natural resources, and also that it is an economic fact that any country should manufacture within its own borders, as far as possible, its own raw materials.

Contrary to a more or less wide-spread belief, there is nothing incompatible in the extension of an industry and the conservation of the raw materials on which that industry is founded. Conservation in the minds of many means leaving the coal and iron or other minerals in the ground or leaving the trees standing, while the true meaning of it is the avoidance of waste; the complete utilization of the raw materials.

We find statistics on all kinds of raw materials showing the quantities taken each year, the quantities exported and imported, etc., but nothing showing the commercial possibilities of real conservation of these materials.

Dealing with the question of coal, which is undoubtedly one of Canada's greatest national assets, coal means power, and the industrial development of a district or a nation depends largely on the quantity of power available as well as its cost. Some parts of our country are possessed of immense water-powers that can be developed to furnish all the power likely to be required for those particular districts for years. Other parts are dependent on coal. We must have coal or gas for domestic use throughout the entire country. In addition we must have fuel for internal-combustion engines, for automobiles, trucks, tractors, farm engines, etc.

Our Canadian coal deposits are quite sufficient to take care of all the coal Canada could possibly use, but under existing conditions the cost of transportation and the fact that special coals are required for special purposes constitute determining factors regulating the supply of Canadian coal to certain districts. A second factor, having the same influence, is the fact that much of the imported American coal, on account of the seams being nearer the surface and easily mined, can be laid down in some sections of Canada cheaper than from the Canadian mines, which are deeper and where the cost of mining is much higher. The question then comes: How far can we so amend our practice as to make our coal stand the transportation charges or compete with the cheaper coal from the United States.

In 1913 Canada produced 15,012,178 tons of coal. We imported 12,096,227 tons of bituminous, 4,208,862 tons of anthracite, and 710,109 tons of coke. In the same year we exported 1,562,020 tons of bituminous and 68,235 tons of coke. From that time forward we either lost ground or remained practically stationary, due to shortage of labour and transportation facilities by reason of war conditions, until the 1918 figures show a total coal production of 15,180,000 tons, with imports as follows:—

Bituminous coal	17,331,177 tons
Anthracite coal	5,253,751 tons
Coke	969,932 tons
The coal exported in 1918	1,902,010 tons
The coke exported in 1918	26,013 tons

I cannot speak with authority for the coal mining interests, but I think it is quite within the bounds of possibility that the output of coal from Canadian mines could be almost doubled from existing openings. If so, we would either

have enough in Canada to supply our own needs, provided we could get it where it is needed, or be in a position to balance accounts with the United States by exporting a portion of our output.

The coal consumption of the country may be roughly divided as follows: For use in the manufacture of coke and gas, railway locomotives, industrial plants and domestic use. In all these there are serious and at the same time preventable losses. There are many individual plants that could show fuel or power reports that would be startling when compared with general practice. At the foot of the list, so far as thermal efficiency is concerned, might be placed the domestic consumption with not over 4 to 5 per cent of the thermal value of the coal recovered. Locomotives are little if any better from an economical standpoint. The general run of industrial plants will not exceed 7 to 8 per cent and in the production of bee-hive coke there is an enormous waste of fuel and by-products. There are, however, many installations which are getting results much in advance of the averages here given, but in most of these cases there is still room for a 50 per cent saving.

I contend that we are not getting anything like the amount of light, heat or power we should, or could get, and I further contend that in getting this extra light, heat and power we would not only be conserving the coal supply but getting cheaper power and at the same time recovering other products which would be of great economic value to the country and lead to the extension of existing industries and the establishment of new ones.

Starting with the importation of anthracite, which is practically all used as domestic fuel. This can be almost entirely eliminated and in so doing give as large returns on the invested capital as any industrial concern in the country.

The substitution of coke as a domestic fuel instead of anthracite is nothing new. It has not been tried out in this country except for the comparatively small stocks of gas coke which are sold by the various city gas plants. There are, however, plants in the United States that cater to a very large domestic and industrial trade in coke. One railroad has used about 700 tons per day of coke in their locomotives for years.

A coke for domestic use can be made from coals which are not suitable for the production of metallurgical coke or for the highest and most economic production of gas in the city gas plants. Different qualities of coke can be made in the same plant, or a different type of plant can be constructed in which, by low temperature distillation, an entirely different type of solid fuel can be made.

While coke is more bulky than anthracite yet tests have proven beyond doubt that pound for pound it is as good or very often better than anthracite as a fuel.

In the production of this fuel many valuable by-products are obtained: Gas, tar, ammonia, benzol, toluol, xylol and naphtha, or combining the latter four a motor fuel much superior to the best gasoline obtained.

The Financial Aspect.

Let us suppose that we go to a district where anthracite costs $9 per ton and bituminous coal $4.50, and put up a plant for the manufacture of coke. This plant would, of course, furnish any metallurgical coke that might be required within the same district, although the coal for this purpose would have to be more carefully chosen. Assuming the plant to handle 2,000 tons of coal per day. The yields of the various products would vary slightly according to the analysis of the coal, but taking, for example, the ordinary Nova Scotia coal, we would get from 2,000 net tons per day 1,400 tons coke, 12,000,000 cubic feet surplus gas of 600 B.T.U., 18,000

gallons of tar, 54,000 pounds sulphate of ammonia, and 4,500 to 5,000 gallons of motor fuel, thus:—

Cost of Coal—	
2,000 tons coal, at $4.50	$9,000 00
Products—	
1,400 tons coke for sale, at $6.50	$9,100 00
12,000,000 cubic feet gas, at 25 cents per M	3,000 00
18,000 gallons tar, at 2½ cents per gallon	450 00
54,000 pounds sulphate, at 2½ cents per pound	1,350 00
4,500 gallons motor fuel, at 30 cents per gallon	1,350 00
	$15,250 00

In the price given for these products I have discounted war prices, and in the case of sulphate of ammonia have deducted enough off the selling price to pay for the acid lime and other expenses of manufacture.

If the price of anthracite falls below that given (and if any conclusions can be arrived at from figures for the past 10 years, there does not seem to be much hope for it) it would be only fair to assume that the price of bituminous coal would also drop. If, on the other hand, anthracite stays at the price given or continues to rise as in the past years, the comparison is all the more striking.

In one year the total cost for raw material would then be $3,285,000, while the returns on products sold would be $5,566,250, or a difference of $2,281,250. Deducting operating expenses for the year, of $500,000, leaves $1,781,250, or approximately 30 per cent return on the cost of the plant, even at the prices of the past two years. With anthracite selling at $9 per ton, the coke, at $6.50 f.o.b. works, could stand a considerable transportation and handling charge and still control the market.

In giving the above figures I have been exceedingly conservative.

The price of coke given is as low, if not lower, than gas coke. The price given for gas is abnormally low, except for certain sections where there is competition by cheap natural gas, but in any district where such conditions do not obtain the price given is very low. The proposition as laid out is, however, strong enough to stand cutting this price materially and still be more than ordinarily attractive. The price figured for sulphate of ammonia is, I think, the lowest it has touched in 15 years.

I have been purposely conservative in order to show more clearly the commercial advantages of adopting this line of business. If there is a market for a rich gas for heating and lighting, the total gas from the coal can be used for this purpose and the plant itself can be heated with producer gas from an inferior grade of non-coking coal. By this means the gas available would be approximately 11,000 cubic feet per ton of coal, instead of 6,000 as in above figures. If producer gas was used the ammonia could be extracted from the coal used in the producers.

Figuring the cost of the coal used in the producers and crediting the recovered ammonia, we find in setting this against the extra gas available for sale that we have considerable additional revenue to add to the total income.

The province of Nova Scotia presents a specific and very striking case where money is being lost to the country. Approximately 200,000 tons of anthracite are imported yearly; at dealers' prices this would mean at least $1,000,000 per year sent out of the country.

A small coke plant erected at the mines where coal cost would be low could produce coke to replace all this anthracite at a price below that at which the anthracite could be imported.

In addition to saving to the province $1,000,000 now sent out of the country the consumer could get as good a grade of fuel much cheaper and the by-products recovered would increase the trade of the province and aid in its further industrial expansion.

Referring back again to the by-products, a word now about their uses and the markets available.

Gas. If the plant is near a large city or thickly populated district, it might all be sold for domestic lighting and heating. This is done in many districts by selling direct to existing gas companies, for no gas company can produce gas at the price at which a by-product coke plant can afford to sell it. Or if there are large industrial works within reach, it can be sold to them and at such a price as to be more economical than coal, or it can be used in gas engines, and power developed. The figure generally accepted as being reasonably conservative for gas-engine practice is 11,500 B.T.U. per horse-power, and it will be readily seen how tremendous quantities of power can be made available from this source.

Gas supplies for domestic use must have the sulphur extracted. This is done by iron oxide, from which the sulphur can be recovered for the manufacture of sulphuric acid, which is needed for the production of ammonium sulphate.

Tar. This product can be used directly as a boiler or furnace fuel by being burned in the same manner as oil, or it can very cheaply be dehydrated and the more highly volatile matter extracted and then used for road binding. Even for firing it would be found advantageous to dehydrate. Some tars, depending on the temperature and conditions of the coking process, can be used as fuel for Diesel engines. The most economical way to handle the tar, however, is to distill it and recover the various volatile fractions, such as the benzol, toluol, naphtha, the carbolic oils, creosote, naphthalene, and pitch.

The benzol, toluol, naphtha, etc., can be added to that recovered directly from the gas, for motor fuel. The crude carbolic finds a market with manufacturers of antiseptics, colours, explosives, and a great deal is used in recent years on the manufactures of phonographic records, imitation amber for pipes, etc.

So far as the value to the country is concerned, the creosote recovered is one of the most valuable by-products of the coal. Railway ties have doubled in price in the past ten years, and there is every prospect of a *pro rata* increase in further years. The forestry branch reports 19,100,000 ties used on Canadian roads in one year. A fairly safe assumption would be a complete renewal of all ties every five years, while fifteen years might be taken as a reasonable average life for creosoted ties. The cost of creosoting is less than the cost of a new tie, so that the creosoting of the ties becomes not only a commercially attractive proposition, but will save many millions of feet of lumber annually.

The same process of reasoning may be applied to mine ties and timbers, and also to bridge timbers.

The general adoption of the creosoting process would materially reduce this number in a few years. If we assume a consumption of only 10,000,000 ties per annum there would be required about 25,000,000 gallons of creosote oil per year, or the distillation of 85,000,000 gallons of tar, which would in turn require the carbonizing of 8,000,000 tons of coal.

The naphthalene finds a market as a colour base. For the manufacture of deodorizers, disinfectants, moth balls, etc., and also in the manufacture of a chlorinated wax for use in electrical work.

The pitch remaining can be made of almost any consistency desired. It can be made so hard that it can be pulverized and used as boiler fuel or in the same state it can be used as a binder for briquettes. In its softer state it is also used as a binder for briquettes, for roofing and road making. It is also mixed with the lighter portion of the distillate for the manufacture of paint for special purposes.

Ammonia. While this has been shown in the balance sheet as sulphate of ammonia which is used almost entirely as a fertilizer, yet it can be recovered in the form of concentrated liquor containing from 16 to 25 per cent ammonia for the manufacture of explosives, or in the form of dry ammonia gas for refrigerator purposes, or as the aqua ammonia of commerce and chemistry. However, these are only small markets when compared with the market as a fertilizer. Its only competitor as a nitrogenous fertilizer is nitrate of soda from Chili, and as the population of the country increases and virgin lands become exhausted, we must, if we are to be fed, keep up the productiveness of the land in a great measure by the use of artificial fertilizers.

An investigation into the yield per acre of Great Britain and the amount of nitrogenous fertilizer used when compared with America will readily substantiate these statements and set at rest any doubt regarding future markets. Considering the agricultural acreage of Canada and the fact that except for such parts as are growing leguminous crops the dressing for some crops should be even as high as 250 pounds of sulphate of ammonia per acre per year, we have further proof of the continuity of the market.

Benzol. Under this name is often included the toluol, xylol and naphtha, which are recovered at the same time. Each of these products, together with naphthalene, can be recovered separately and refined to their chemically pure state, and there will undoubtedly be a market for a small quantity of each for solvents, dry cleaning, dyes, explosives, etc., During the war the toluol and a considerable portion of all benzol recovered was used in the manufacture of explosives.

The great market now the war is over is undoubtedly to combine the four products, benzol, toluol, xylol and solvent naphtha, as a motor fuel, giving a product which distills between 78 and 165° C. This fuel has been carefully tested and found to give from 20 to 30 per cent greater mileage than the best gasolene, with about 15 per cent greater power, easier starting, no knock with advanced spark and actually less tendency for the formation of carbon in engine cylinders. Benzol itself comprises approximately 70 per cent of the fuel and this freezes at 44° F. The addition of the toluol and other products named, in the proportion in which they are recovered, brings the total fuel mixture down to a freezing point of approximately zero F., so that to make an all-year fuel for our climate we have to mix with sufficient gasolene to lower the freezing point still further. The addition of 25 to 30 per cent of gasolene gives a freezing point low enough for most places, except in the north, where it might be necessary to add as high as 50 per cent.

According to Government statistics, Canada's consumption of gasolene in 1916 was 74,000,000 gallons, of which 18,000,000 gallons was imported as distilled product, and most of the remainder was made from imported crude oils. So that it is evident that with a total Canadian production of say 20,000,000 tons of coal, if it was all carbonized and the motor fuel recovered, the market would still be far short of being satisfied. This does not take into consideration the fact of the continued yearly increase in consumption which is bound to occur.

In the low temperature distillation of coal as distinct from the ordinary coking practice the same products are recovered, but some of them in different proportions. The solid fuel is about the same. The ammonia the same or

slightly less, but the tar is three or four times as much. It is, however, of a very different quality, containing much of the lighter hydro-carbons which in coking practice are afterward recovered from the gas.

There are several patented fuels being made by this process such as coalite, carbo-coal, etc., and the process has long passed the experimental stage. It will undoubtedly be found economically sound and commercially attractive to use this process in some districts.

The Eastern District. Following along the lines above suggested there does not seem to be any good reason why Nova Scotia coals should not cover the market for domestic fuel even to the head of lake Ontario. The mines of Nova Scotia are practically all either on or within a few miles of tide water and good harbours, so that the transportation problem becomes a relatively simple one.

The quantity of coal available is enormous, and there is no doubt that the output can be largely increased and put on board steamers at such a price as to make the erection of a distillation plant and the invasion of the Quebec and Ontario anthracite market a highly profitable investment.

The Central District. For the Niagara peninsula and the district lying west thereof, which cannot be economically reached by fuel from the Alberta and Saskatchewan fields, it will undoubtedly be necessary to import American coal or heavily penalize that district in the matter of price. But I contend that we should import bituminous rather than anthracite. In the first place we send less money out of the country, and, secondly, we can erect plants in that district, and as already shown, make a clean smokeless fuel, which possesses all the advantages of anthracite at a much lower price and at the same time have the benefit of all the by-products recovered.

The Western District. In the Alberta and British Columbia districts the same process can be carried out, providing them with a fuel for domestic use superior to the bituminous coals. The coke now made in bee-hive ovens for metallurgical use in Alberta and British Columbia should be made in by-product ovens.

Production Cost. It means a saving of at least 10 per cent of the coal actually put in the ovens, as well as the recovery of the by-products. I give herewith a comparison between bee-hive and by-product ovens, from tests actually made on Nova Scotia coal:—

Comparison Beehive and By-Product Coke

Beehive—

Ordinary type, 12·5 feet in diameter.
Produces 4 net tons coke in 48 hours or 2 net tons per day of 24 hours.
Yield of coke from coal, 60 per cent.
By-products and surplus gas, none.

By-Product Oven—

Oven charge, 11 net tons.
Coking time, 16 hours.
Coke produced: 71 per cent yield; 7·8 net tons per oven; 11·7 tons per day of 24 hours.

By-Products—

Ammonium sulphate.—27 pounds per ton, equal to 38 pounds per net ton coke; value 2·5 cents per pound above cost of manufacture; equal to 95 cents per ton of coke.

Tar.—9 gallons per ton of coal; 12·7 gallons per ton of coke; value 2·5 cents per gallon, equal to 31¾ cents per ton of coke.

Surplus gas.—6,000 cubic feet per ton coal; equal to 8,450 cubic feet per ton of coke, at 25 cents per 1,000 cubic feet; equal $2.11 per ton of coke.

Motor fuel.—2¼ gallons per ton of coal; equal to 3·17 gallons per ton of coke; value 30 cents per gallon; equal to 95 cents per ton of coke.

Total value of By-Products as above—	
Ammonium sulphate	$ 0 95
Tar	0 31
Gas	2 11
Benzol products	0 95
Per ton of coke	$ 4 31

Add to the above the difference between 60 per cent yield in beehive ovens and 71 per cent in by-product ovens on the same coal, taking coal at $2 at the ovens.

Coal per ton of coke in beehive oven	$ 3 32
Coal per ton of coke in by-product oven	2 80
Balance in favour of by-product oven	0 52
Total saving per ton, $4.31 plus 52 cents	$ 4 83

Resulting in $56.51 per oven in 24 hours, or $20,626.15 per oven per year, which amount according to pre-war prices would pay for the building of the by-product oven.

British Columbia produces annually about 275,000 tons of coke all in beehive ovens. If this was coked in by-product ovens and the coal would give the same returns as that tested in the above comparison, the amount saved in coal and by-products would be sufficient to pay for the plant in two years at least, in addition to the economic factors with regard to the saving of coal and the recovery of other valuable products.

The labour cost per ton of coke is lower in by-product practice than beehive.

British Columbia presents somewhat a different problem from most of the other sections of Canada regarding the development of power by gas on account of the large water-powers which can be cheaply developed, and yet taking into consideration the fact of the value of by-products recovered it can actually be shown that electric power can be generated as cheaply by gas as by water.

Briquetting. I understand that in many of the mines there is a considerable amount of very fine coal wasted on account of there being no market. This can be handled in two ways. If it is a coking coal, coke it and recover the by-products. If a non-coking coal, briquette it, using the pitch from the tar recovered in the coke ovens, as a binder. A coal, which may on storage lose calorific value, and have a great tendency to spontaneous combustion, may be briquetted with the addition of 7 to 10 per cent of pitch, and be stored for any length of time in any climate without disintegration, loss of calorific value, or danger of spontaneous combustion. In addition to this the briquettes give from 15 to 25 per cent greater efficiency when burned than the coal from which they were made.

This has been known for many years in France, Belgium and Germany, and in many cases they have been crushing their best steam coals and briquetting them.

Exhaustive tests were made a few years ago, just along these lines, by the American fuel testing department, and the results they obtained, agreed fully with European practice.

These briquettes could be made much more cheaply if the binder was recovered in the same district, and with the combination of the coke oven and the briquetting plant they should be able to manufacture a high-grade fuel for which there should be a considerable market in the states just to the south.

Alberta Lignites. Referring to the lignites of Alberta and Saskatchewan, it seems probable that the development of these deposits must be limited to practically the amount required for local consumption, until some process is found by which they may be made into a fuel which will stand weathering and handling to the same extent as the true coals.

All of the records which we have on the investigation into the commercial possibilities of the lignite deposits show that there is still much that may be done.

There are a number of experiments which might yet be tried without running into any great expenditure and from which much might be hoped for. But I would strongly recommend that this work be put in charge of some one who is thoroughly familiar with the line of work. Under existing conditions, with the limited amount of knowledge we have, no one can say with any degree of certainty what might be the possible development of these fields. That there are reasonable grounds for hope for the solution of the problem on a commercial basis, I feel certain, and considering what a satisfactory solution would mean to the development of these two provinces, the government would be amply justified in making any reasonable expenditure to find the answer.

Locomotive Coal.

The question of getting a higher degree of efficiency out of the coal burned on locomotives is one that has been given considerable attention by engineers for some time, but because of the very fact that it is a locomotive and must be kept within certain limits of size and weight it has been found impossible to instal much of the apparatus that makes for greater economy in stationary plants.

The ultimate solution of the problem is undoubtedly to electrify the various roads.

I do not know what proportion of the operating expenses of a railroad is made up of the fuel cost, but considering the difference between say 4 to 5 per cent thermal efficiency from the coal as now used, and 15 per cent as might be obtained by gasifying the coal and generating electric power, the question can well bear very careful consideration by the railroad boards.

Industrial Plants.

Turning to the question of industrial plants and power development, we enter such a complex situation that it is impossible to go very deeply into specific details which will be applicable to all places and under all conditions. We find industries of so many different kinds, so many different sizes and operating under such different conditions that we can only hope to compare some methods of existing practice with what might be done and leave the details to be worked out for each individual case as it comes up.

It can be readily appreciated for instance that a certain type of plant might be put in to generate 10,000 k.w. and be an attractive commercial investment while the same type of plant would not be nearly so attractive for a 100 to 500 k.w. unit.

One has only to visit many of the industrial establishments, both large and small throughout the country, to see the great waste of fuel that is going on. A casual glance at the smoke stacks alone will tell the story. It is of course practically impossible to find out how much coal is being wasted in this way throughout the country, but it is safe to say that in general from the fuel burned there is not more than 60 per cent of the power generated, as compared to what might be obtained under the best conditions.

The question of power cost is more often than not the determining factor in the location or establishment of a given manufacturing plant. We see evidences of this in the segregation of so many manufacturing plants around Niagara Falls or other districts where power is reasonably cheap.

I wish to show how by proper utilization of the gas from by-product ovens and by the gasifying of non-coking coals and co-operation on the part of various industries and municipalities, cheap power can be had throughout sections of the country not so favourably situated.

I have already dealt with the gas from by-product ovens and shown something of the possibilities of power development, if there is sufficient of it after

catering to the lighting and heating requirements of the district. The quantity of this gas is in a measure limited by the quantity of coke which can be disposed of from the same district. A big field for power development is, however, found, by the use of non-coking or even coking coals in producers, and it is a question if power generated by this gas is not even cheaper than that generated by water-power. In 1917 a comparison of gas-power and water-power plants was made by Mr. H. G. H. Tarr, of the R. D. Wood Co., of Philadelphia, which I give herewith:—

20,000-h.p. Water Power Plant.

Cost of 20,000 h.p. Water-power plant in 1908 estimated as $3,555,000. Assuming an increase in cost of 50 per cent, the same plant would cost now $5,333,000.

Operating Cost per Year.

Labour	$ 60,000
5 per cent interest on $5,333,000	266,500
Sinking fund	150,000
Repairs and depreciation	139,500
Taxes and insurance	40,000
Total operating cost	$656,000

Income Water-Power Plant.

Considering a load factor of 84 per cent, an average of 17,000 h.p. will be delivered every day in the year equal to 111,100,000 kw.-hr. per annum. Assuming for comparison that 1 k.w.-hr. sells at 1 cent, the total income per year would be. $1,111,000

Profit of Water-Power Plant.

Total income as calculated above	$1,111,000
Total operating cost calculated above	656,000
Profit per annum	$ 455,000
or 8·5 per cent on total investment of	$5,333,000

20,000 h.p. Steam-Power Plant with Mond By-Products Recovery.

In 1908 we calculated the cost of the gas plant at $600,000. The present-day cost will be about 50 per cent higher, or	$ 900,000
The boiler plant would consist of 8,000-h.p. boilers for active service and 2,000-h.p. boilers for spare capacity, or a total of 10,000 h.p. Estimating the cost at $30 per boiler horse-power, the boiler plant will cost, erected	$ 300,000
The turbo-generator plant would consist of 20,000-h.-p. turbo generators for active service and 6,000 h.-p. for spare, or total of 26,000 h.-p. Estimating the cost at $40 per horse-power the turbo-generator plant will cost erected	$1,040,000

The total investment of the steam plant, therefore, would be as follows:—

Cost of coal lands, say	$ 500,000
400-ton Mond by-product gas plant	900,000
20,000-h.-p. turbo-generator plant	1,040,000
Cranes	12,000
Switchboard	34,000
Boiler building	80,000
Generator building	50,000
Incidentals	244,000
Total investment	$2,860,000

Operating Cost per Year.

Labour	$ 70,000
Interest, 5 per cent on $2,360,000	118,000
Interest on coal lands cost of $500,000 at 5 per cent	25,000
Sinking fund	100,000
Repairs and depreciation	130,000
Taxes and insurance	30,000
Coal, 149,000 tons (2 pounds per horse-power hour) at $1.50	224,000
Acid (1 ton per ton of sulphate) at $12	63,000
Total operating cost	$ 760,000

Income Steam Plant.

Current at 1 cent per kilowatt-hour, as before	$1,111,000
Sulphate (70 pounds per ton of coal) at 3 cents per pound	312,900
Total income	$1,423,900

Profit of Steam Plant.

Total income as calculated before	$1,423,900
Total operating cost calculated before	760,000
Profit per annum	$ 663,900
or about 23 per cent on total investment of	$2,860,000

From this it would appear that a by-product gas plant is more economical than a water-power by about 14·5 per cent under the same conditions of load, etc.

The producer gasifies all the coal, giving approximately 140,000 cubic feet of gas per ton, having a heating value of 135 to 140 b.t.u. per cubic foot. In this process far more of the nitrogen content of the coal is recovered in the form of ammonia than in ordinary coking practice, because in the latter, a certain percentage remains in the coke and also in the tar. The actual ammonium sulphate recovered in gas producer practice is from 2½ to 3 times as great as in coking practice, or say, 70 to 80 pounds per ton of coal gasified.

Many small manufacturing plants with their own boiler plant do not really know how much power they are using, or, beyond what they pay for coal and labour, how much their power is costing per unit. If the various industries in a city, or over a considerable area that has to depend on coal to raise power, were carefully investigated and these industries were to unite to put in a central power plant with by-product recovery, they would not only get cheaper power, but the working conditions would be better, the district would be healthier and cleaner, valuable coal would be saved, which is now going to waste, and much needed by-products recovered.

Independent capital could of course accomplish the same thing, but if this whole question was put up to the manufacturers associations throughout the country, they could not possibly help but see the opportunities offered. There were a number of plants of this kind in operation in England, even some years ago. One in Staffordshire was distributing gas and power over an area of 123 square miles and supplying power to approximately 2,000 industrial plants.

Powdered Coal.

A few words might be said about the use of powdered fuel as a means of conserving coal. This is undoubtedly a great advance over the general stoking practice, and designers and builders of powdered fuel plants make claims that with coal at $3 per ton, natural gas at 35 cents per thousand cubic feet and fuel oil at 6 cents per gallon, the British thermal units produced for 1 cent are as follows:—

Fuel oil	21,596
Natural gas	28,571
Producer gas	45,627
Powdered coal	63,035

The figures per day are given as follows:—

Natural gas	$ 525
Fuel oil	694
Producer gas	328
Powdered coal	237

The object in powdering the coal is to make it as near like a gas in its behavior as possible and in the comparison with producer gas no consideration has been given to the production of ammonia at the producer plant. Assuming ordinary recovery, the daily figure for producer gas would be about $190 or 20 per cent lower than powdered coal.

The installation of an equipment for burning powdered coal is, however, fairly cheap, and in units where power cannot be drawn from a central source or where the amount of power to be developed is not such as to warrant the installation of a by-product producer plant there is much to be said in its favour.

Oil Shales.

A few words about another source than coal distillation, from which we can recover large quantities of gasolene, oil fuel and other oil products as well as ammonia.

We have in some parts of Canada, most notably in New Brunswick and Nova Scotia, very large deposits of oil shales. In Nova Scotia alone, in Pictou county, there has been estimated to be 500,000,000 tons of oil shale, which will yield a minimum of 30 gallons of oil to the ton, of which 50 per cent is available for motor fuel. The remainder makes fuel oil, lubricating oils and greases.

It is estimated that these shales will yield 400,000,000 barrels of oil, and 7,000,000 tons of ammonium sulphate.

I do not know of any estimate of quantities in New Brunswick shales, but some of them are as high, if not higher in quality than the Pictou deposits, and judging from the area over which they have been traced the deposits must be at least equally extensive.

The oil-shale industry has been a very profitable one in Scotland for years, where they have distilled a lower grade of shale than ours and in most cases have had to mine it the same as coal. Most of our deposits could be mined by open-pit methods. This fact, together with the high yield of oil, should make the development of these deposits a very profitable investment and still further aid in expanding Canadian industry, and supplying products now imported or manufactured from imported raw materials.

Government Department of Industry.

What we need more than anything else to arouse public interest and to show what can be done and what economies can be effected is a Government Department of Industry, headed by a big broad-minded business man, who would get together the best existing practice in the various branches of industry and disseminate it among those who need it.

The question of research work, looking toward the discovery of new products, or better methods, is important and much to be desired, but is undoubtedly of secondary importance to the education of our industries up to the best practical and well-proven modern practice.

If our country is going to develop or rather if we as Canadians are going to develop it so that it will become something besides a storehouse of raw materials for others we must set to work in earnest at once.

Now that the whole world is in a measure starting all over again after having devoted all its energies for nearly five years to the prosecution of the war, it seems to be the psychological moment for starting right. Labour costs are high, living cost is high, and unless we are content to see both keep mounting in an ever-ascending spiral, we must expand our industries, cheapen our products and increase the yields from our land with the same labour expenditure.

How far government control or government aid can be invoked to help toward the desired end is a question that might well be given very careful study. A Federal bank for the express purpose of helping to finance industrial and agricultural projects which are proven economically sound, might be feasible. I believe the German industrial expansion was largely made possible by just such means.

It has been said that the last fifty years belonged to the United States and the next fifty belong to Canada. The latter may be true, but unless we reach out and take it, some one else will see it first and the process of buying back will be long and expensive.

F. E. LUCAS.

Sydney, N.S., February 25, 1919.

TABLE showing Coal Resources of North America and Exhaustion to date (Net Tons).

(c)

Province or State.	Original Mineable Coal.				Exhaustion to Date. (All kinds).
	Anthracite.	Bituminous.	Lignite.	Total.	
Alberta	1,182,571,708	217,593,194,364	963,795,942,428	1,182,571,708,500	44,516,881
Arctic Islands		6,615,000,000		6,615,000,000	
British Columbia	670,628,188	77,289,898,719	5,867,996,648	83,828,523,555	60,630,453
Manitoba			176,400,000	176,400,000	
New Brunswick		166,477,500		166,477,500	1,344,353
Nova Scotia		10,715,162,220		10,715,162,220	172,322,387
North W. Territory			5,292,000,000	5,292,000,000	
Ontario			27,562,500	27,562,500	
Prince Ed. Island					
Quebec					
Saskatchewan			65,942,730,000	65,942,730,000	3,707,798
Yukon	46,293,975	231,469,875	5,168,586,150	5,446,350,000	
Alabama		67,613,679,000		67,613,679,000	517,361,982
Arizona		10,032,750	14,147,831,250	14,157,864,000	
Arkansas	90,620,208	1,397,061,540	400,239,252	1,887,921,000	69,622,092
California		27,537,584	16,452,166	43,989,750	7,739,530
Colorado	293,925,417	131,443,447,323	64,212,906,510	195,950,279,250	341,414,715
Georgia		933,376,500		933,376,500	15,179,811
Idaho		600,163,956	100,144,044	700,308,000	
Illinois		201,491,136,000		201,491,136,000	1,988,389,228
Indiana		53,075,121,750		53,075,121,750	538,855,858
Iowa		29,173,252,500		29,173,252,500	339,202,338
Kansas		30,013,578,000		30,013,578,000	247,110,979
Kentucky		123,384,082,500		123,384,082,500	499,147,573
Maryland		8,048,250,000		8,048,250,000	296,899,009
Michigan		12,005,453,250		12,005,453,250	43,936,566
Missouri		84,038,062,500		84,038,062,500	215,900,610
Montana		2,669,020,200	378,619,579,800	381,288,600,000	88,695,304
New Mexico		19,000,822,475	172,926,677,275	191,927,499,750	91,871,659
North Dakota			698,246,104,500	698,246,104,500	13,045,108
Ohio		94,010,175,000		94,010,175,000	1,268,845,957
Oklahoma		54,976,383,000		54,976,383,000	119,904,318
Oregon			1,000,408,500	1,000,408,500	3,491,293
Pennsylvania	20,980,593,853	112,653,761,897		133,634,355,750	9,716,272,407
South Dakota			1,020,804,750	1,020,804,750	
Tennessee		25,676,673,750		25,676,673,750	232,007,481
Texas		8,001,580,073	23,012,296,177	31,013,876,250	56,497,933
Utah		88,221,174,285	159,084,465	88,380,258,750	80,583,364
Virginia	900,407,340	21,609,776,160		22,510,183,500	213,396,715
Washington		11,439,366,246	52,467,707,754	63,907,074,000	121,586,767
West Virginia		152,614,113,750		152,614,113,750	1,800,948,769
Wyoming		80,590,426,139	590,437,268,611	671,027,694,750	236,784,757

PART TWO OF THE FUEL CONTROL BULLETIN No. 3, INCLUDING REGULATION NOW IN FORCE, APPROVED BY ORDER IN COUNCIL 5TH DECEMBER 1918.

General Organization.

Fuel Commissioners are responsible to and should report to the Provincial Fuel Administrator, who, in turn, reports to the Fuel Controller at Ottawa. This principle ensures promptness and the certainty of local problems being dealt with by officers possessing a knowledge of local conditions, which is the cornerstone of all good organization.

As soon as a Local Fuel Commissioner has been appointed, he should at once put himself in touch with the Provincial Fuel Administrator, to whom he should also address all communications regarding fuel matters in his municipality.

Municipal Organization.

Paragraph 4 of Regulation "A" reads as follows:—

"The Council of any municipality may appoint a Local Fuel Commissioner or Board of Fuel Commissioners, with such organization as may be deemed necessary. Any expenses so incurred shall be borne by the municipality."

Some municipalities may, through indifference, fail to make such an appointment, or may not consider it necessary. This decision, is of course, entirely in the hands of the local authorities. The Fuel Controller and Fuel Administrators cannot, however, undertake to assume the slightest responsibility for the fuel supply of any community that fails to take this very first and simple step towards self protection. If any municipality considers that the fuel problem is not likely to become acute, there is no objection whatever to the appointment as Fuel Commissioner of one of the civic officials, the Town Clerk or Engineer, but it is most desirable that some person should be available to assume responsibility for the local fuel situation and to be able to advise the Fuel Administrator in case of any sudden emergency.

Work of Local Fuel Commissioners.

It will be realized from the foregoing that the Local Fuel Commissioner is the most important unit in the organization, for he is literally in the "firing line." He should be a man of tact and sound judgment. It stands to reason that the Fuel Controller at Ottawa cannot be in touch with the requirements of every municipality throughout Canada, and it is for the Fuel Commissioner at each point to study how the regulations can be applied in the best interest of the community in which he lives. As before stated, he should report to and consult with the Fuel Administrator for the Province, whenever it may be necessary.

Co-operation of Dealers.

Early action should be taken by the Local Fuel Commissioner to call a meeting of the dealers in his territory and to see that they "pull together" with him. Dealers should be made to understand that the fullest co-operation will be expected of them.

Broadly speaking, the Fuel Controller desires to develop amongst the coal dealers a spirit of willing co-operation with the Local Fuel Commissioner. A consultation with these men should cause them to understand the situation right from the start. The whole problem of administering coal distribution then will be immensely simplified and the organization will be better prepared to meet any emergency that may arise.

The Clearing House.

A knowledge of the requirements of the individual domestic consumer and of the deliveries made to him from time to time is requisite. In the regulations the information which applicants are required to give is fully laid down in Schedule "A" to Regulation " B," which is reproduced at the end of this bulletin. This form of consumer's statement must be used by the dealers, who are expected to furnish printed forms to be filled out by their customers. If considered expedient, an arrangement could be made locally by which the municipality could have sufficient forms printed to supply each dealer.

When a dealer receives an order from any customer for a winter's supply of domestic coal, he at once fills in this form, which is signed by the consumer certifying to its correctness and by the dealer as accepting the order. It is then mailed to the Fuel Commissioner, and is placed in an alphabetical index under the customers of the firm of the coal dealer accepting the order. A Shannon file might be devoted to each dealer and these returns placed thereon alphabetically.

Each dealer also makes a daily return to the Fuel Commissioner of deliveries made. Upon receipt of this return, the Fuel Commissioner enters up each return under the firm's customers. In this way there will be a record up to date of the deliveries made by each coal dealer and the receipts by each domestic consumer. The routine would be exceedingly simple, and a complete check would be available of the amount of coal in the hands of each domestic consumer in the municipality at any time. In this way hoarding of coal would be absolutely avoided.

A control system such as this might be found too cumbersome for the very largest Canadian cities. It is only given as a suggestion and can, of course, be varied in any way that might be found desirable and expedient.

Watching the Situation.

It is expected that the Fuel Commissioners will keep close track of the local situation in each municipality and will thus be in a position to advise the Fuel Administrator from time to time, so that there may be no obstacles whatever placed in the way of the prompt distribution of coal received by the dealers. No attempt should, however, be made to force dealers to stop coal deliveries for the purpose of building up stores in their yards, except to a very small extent.

Industrial Coal.

It is suggested that municipalities should confine their attention to regulating the domestic coal supply. It is taken for granted that industries and other large consumers will have made their own arrangements for an adequate supply of coal, and will apply direct to the Fuel Administrator should they experience any difficulty in obtaining regular and satisfactory deliveries.

Emergencies.

If there is reason to suppose that any municipality will have to face the problem of even a temporary fuel shortage at any period of the winter, it might be well to inaugurate a system whereby coal distribution is systematized and regulated. Obviously, if there is any likelihood of such a system being required, it should be started as early in the season as possible, in order that the foundation may be laid for intelligent control, thus avoiding or minimizing the effect of any temporary fuel shortages. It may, of course, be difficult to forecast the situation, but those municipalities who suffered during the past winter may probably consider that no chances should be taken of plentiful supplies of coal not being available, and that the safety of the community demands a systematic control from the beginning.

Under emergency conditions, the Local Fuel Commissioner should instruct the dealers that they are not merely to supply their regular customers. Their duty is to conform to the situation and make such deliveries as he may requisition.

The Problems of Emergency Conditions.

In cases of emergency the three most important problems for the Fuel Commissioner's consideration, will be:—

(1) To ascertain whether any person applying for coal has a sufficient quantity on hand to last him for some little time. All such applicants should, of course, be refused when an emergency arises, and they should be instructed to come back three or four days before they are entirely out of coal.

(2) To satisfy himself that under emergency conditions no quantity greater than a quarter of a ton or half a ton, whatever the circumstances might warrant, is delivered to any one individual. This will ensure the available supply being utilized for the benefit of the greatest possible number of people.

(3) With emergency conditions prevailing, and more or less panic associated therewith, and individual deliveries reduced to small quantities, an unusual burden is invariably placed upon the delivery facilities of the dealers. Possibly only one dealer may have coal available, and his outfit would generally fall far short of making quick deliveries to the large number of applicants he would be called upon to supply. This suggests close co-operation amongst the dealers in regard to delivery, and also calling in the aid of cartage concerns and any town equipment that may be available. It is frequently necessary to run emergency deliveries for long hours and on Sundays, in order to successfully cope with the situation, all of which will, of course, require a great deal of tact and organizing ability on the part of the Fuel Commissioner.

Paragraph (15) of Regulation " B " gives him the necessary authority:—

> "The Fuel Commissioner may by written notice directed to any fuel dealer, carter, or any other person within the municipality requisition the use of any horse, wagon, sleigh and other delivery equipment owned by or being in the custody of such person for the purpose of expediting coal deliveries during any period when an emergency is deemed by such Fuel Commissioner to exist. He shall also fix the remuneration and make directions for the use of such equipment. Failure to comply with such notice or to obey such directions shall render the offender liable to a fine not exceeding $100 for each offence or in lieu thereof imprisonment for a term not exceeding three months or to both fine and imprisonment."

Dealers Returns.

Section 16 of Regulation " B " provides for daily returns of coal receipts, deliveries and prices, to be furnished the Fuel Commissioner by each dealer within his jurisdiction. Following is the wording of the Section:—

"The Fuel Commissioner may by written notice require any dealer within the municipality to furnish him daily with statements showing—

(*a*) Tonnage of coal of various classes received the previous day and total quantity on hand.

(*b*) A list of orders for coal booked by him the previous day.

(*c*) A list of coal deliveries, showing quantity by class and name and address of each recipient made by him the previous day.

(*d*) The prices charged for coal so delivered."

Outside Sales.

The question is frequently asked what the attitude of the Fuel Commissioner and dealers should be in time of scarcity, regarding orders from persons living outside the corporation limits. If such people have in the past purchased coal in the municipality in question and have no other means of obtaining fuel, their needs should be given the same consideration as others. An exception, however, may be made in the case of farmers known to have wood lots, who should be refused coal during any crisis. Fuel Commissioners' attention is called to the provisions of Section 6 of Schedule " A " to Regulation " B."

Legal Powers.

The Fuel Commissioner's responsibilities are outlined in the regulations by the Fuel Controller, who also takes occasion to impress on dealers the absolute necessity of assisting by whole-hearted co-operation with this official in every possible way. Should any dealer refuse to do his part, and satisfactory evidence to that effect is brought before the Fuel Administrator, the legal power exists, and will unquestionably be exercised forthwith, to suspend or cancel the permit under which such dealer conducts his business.

General.

The Fuel Controller and Provincial Fuel Administrators expect Local Fuel Commissioners to assist in the general enforcement of the regulations within their municipalities and to acquaint themselves fully with the provisions of these regulations. Needless to say, the Fuel Controller will at all times be glad to receive any helpful and constructive advice and suggestions from Fuel Commissioners bearing on general problems, and feels confident that in the discharge of their duties they will exercise tact and diplomacy and give sympathetic consideration to the difficult task confronting coal dealers at this time, realizing that upon these men will rest very largely the responsibility of obtaining an adequate supply of coal for their trade.

No directions for the guidance of Fuel Commissioners would apply under all the varied local conditions prevailing throughout Canadian municipalities. These officers will be expected to deal with any local situation that may arise, according to their best judgment, fairly and impartially. The Provincial Fuel Administrator will advise and assist them when appealed to. They may greatly assist the cause by generally promoting economy in the use of fuel, and by urging the use of coal substitutes, particularly wood, where practicable. They may make recommendations to the municipal council regarding the closing, or partial closing, of public buildings during periods of scarcity and urge, where necessary, limitations in the use of places of amusement, public halls, churches, etc., when the fuel stocks get below the safety mark.

REGULATIONS REGARDING ORGANIZATION AND THE LICENSING OF COAL DEALERS.

Issued by the Fuel Controller for Canada.

A

Approved by Order in Council, 5th December, 1918, P.C. 3004.

INTERPRETATION.

(1) In these and all other regulations issued by the Fuel Controller unless the context otherwise requires:—

(a) "Operator" means a person who mines coal and sells the same.

(b) "Broker" means a person who buys and sells coal or arranges such transactions between buyer and seller, but in either event does not physically receive and handle the coal.

(c) "Wholesale dealer" means a person who physically handles and sells coal to a retail dealer.

(d) "Retail dealer" means a person who physically handles and sells coal to a consumer.

(e) "Dealer" means any wholesale or retail dealer.

(f) "Importer" means a person who imports coal from without the Dominion of Canada.

(g) "Consumer" means a user of coal for domestic, industrial or any other purposes.

(h) "Fuel Administrator" means any individual or board appointed under paragraph 2 of these regulations.

(i) "Fuel Commissioner" means any individual or board appointed under paragraph 4 of these regulations.

(j) "Coal" means coal or lignite.

(k) "Person" includes natural persons and bodies corporate.

ORGANIZATION.

Provincial.

(2) The Government of each of the provinces of Canada may appoint a Provincial Fuel Administrator or Board of Administrators for such province, and may create such central provincial organization as may be deemed necessary. Any expense so incurred shall be borne by each province.

(3) The powers and duties of Fuel Administrators shall be:—

(a) To supervise the distribution of all coal and other fuel imported into or made available within such province.

(b) To develop the demand for and supply of wood and other coal substitutes to the greatest possible extent.

(c) To promote and administer any organization prescribed by these regulations within the province.

(d) To gather and compile statistics dealing with the production and consumption of fuel of all kinds within the province.

(e) To promote within the province the greatest development of any coal areas available.

(f) To issue orders to dealers, consumers and others within the province regarding the distribution and use of coal not inconsistent with any regulations by the Fuel Controller that may be in force.

(g) Generally to assist and advise the Fuel Controller for Canada in the discharge of his duties and to enforce any regulations that may from time to time be prescribed by him.

Municipal.

(4) The Council of any municipality may appoint a Local Fuel Commissioner or Board of Fuel Commissioners with such organization as may be deemed necessary. Any expenses so incurred shall be borne by the municipality.

(5) On the petition of two-thirds of the dealers in any municipality addressed to the Fuel Administrator preferring complaint against any Fuel Commissioner, the said Fuel Administrator shall forthwith cause an investigation to be made into the said complaint, and if sufficient cause be shown, may call upon the municipality to remove such officer.

(6) The duties of Fuel Commissioners shall be:—

(a) To co-ordinate the work of fuel dealers in apportioning and delivering coal during any period of fuel scarcity within such municipality.

(b) To institute when deemed necessary a system of controlling retail coal deliveries through orders on dealers within the municipality issued by the Fuel Commissioner.

(c) Generally to assist the Fuel Administrator in enforcing such orders and regulations as may from time to time be made by the Fuel Controller for Canada or by the Fuel Administrator.

LICENSING OF DEALERS AND IMPORTERS.

Importers' Permits.

(7) Any person importing or who desires to import coal into Canada shall forthwith mail to the Fuel Controller by registered letter an application for permit in Form "A" and if approved an importer's permit in form "B" shall be issued. Such permit shall be prominently exposed in the permittee's office. No one shall import coal into Canada for any purpose whatever without obtaining a permit in said form "B."

(8) A fee based on the tonnage imported by any applicant during the previous coal year shall be charged by the Fuel Controller for an importer's permit as set forth in schedule "E" hereto, and such importer's permit shall only be valid for the coal year within which it is issued.

Provided that an importer's permit may be issued to any applicant who did not import coal into Canada during the previous coal year on payment of the minimum fee prescribed in the said schedule "E."

Dealers' Permit.

(9) Any person engaged in or who desires to engage in the business of selling coal as a broker, wholesale or retail dealer, shall forthwith apply to the Provincial Fuel Administrator as hereinafter set forth for a permit in Form "D (a)" or "D (b)." Such permit must be prominently exposed in the permittee's office. No one shall commence the business of selling coal as a broker, wholesaler or retailer, without first obtaining a permit in said Form "D (a)" or "D (b)" as the case may be.

(10) A fee based on the tonnage sold by any applicant during the previous coal year shall be charged for a dealer's permit as set forth in schedule "E" hereof, and such dealer's permit shall only be valid for the coal year within which it is issued.

Provided that dealer's permit may be issued to any applicant who was not engaged in the business of selling coal during the previous coal year on payment of the minimum fee prescribed in schedule "E" hereof.

(11) Dealers or brokers carrying on business and accepting orders for coal in more than one office or who maintain branch offices within the same municipality or in other municipalities must secure a permit for each such separate office.

(12) Every application for a dealer's permit shall be in the form set forth in schedule "C" and shall be mailed by registered letter with all fees payable therefor to the Fuel Administrator for the province within which the applicant conducts business.

(13) On receipt of any application for a dealer's permit and the proper fee therefor the Fuel Administrator shall, if the application be approved by him, mail to the applicant a receipt for the amount so paid, and the said application form shall then be mailed by him to the Fuel Controller, with his approval, and the amount of the fees collected endorsed thereon, and the Fuel Controller shall then issue the said permit.

(14) On receipt by the Fuel Administrator of an Application for a dealer's permit and the proper fee therefor, if the said application be not approved by him the said fee shall be returned to the applicant and a report shall forthwith be made by the Fuel Administrator to the Fuel Controller stating the reason for disapproval. A copy of such report shall also be mailed by him to the said applicant.

(15) All fees collected by the Fuel Administrator in respect to dealers' permits shall be paid by him to the Government of the province and shall be utilized by such province towards defraying any expenses incurred in connection with the office of the Fuel Administrator for such province.

Cancellation of Permit.

(16) In case any importer, broker, or dealer fails to obey any directions in writing issued by the Fuel Administrator or the Fuel Commissioner, or is found guilty of having given short weight, or in case there is other sufficient cause as to which the Fuel Controller shall be the sole judge, the said Fuel Controller may forthwith suspend or cancel any permit issued by him upon giving notice to the permittee by registered letter, and may afterwards renew such permit as he may in his discretion see fit.

Illegal Dealing in Coal.

(17) Any person who commences or continues to import or deal in coal without having made application for Permit as herein provided, or who has been notified by registered letter by the Fuel Controller that the said application has not been approved, or that any permit issued to him by the Fuel Controller has been suspended or cancelled, shall on summary conviction be guilty of an offence and be liable to a fine not exceeding $500 or imprisonment for a period not exceeding six months. A penalty not exceeding $50 for each day such business is conducted in contravention of these regulations may also be imposed.

(18) These regulations shall be in force and effect from and after the seventh day of December, 1918.

C. A. MAGRATH,
Fuel Controller.

Ottawa, 5th December, 1918.

REGULATIONS REGARDING THE IMPORTATION, SALE AND DELIVERY OF COAL.

B

Issued by the Fuel Controller for Canada.

Approved by Order in Council, 5th December, 1918, P.C. 3004.

LOCAL CONTROL AND DISTRIBUTION.

(1) The Fuel Administrator may give directions in writing to the Fuel Commissioner within any municipality respecting the equitable distribution and prompt delivery of coal therein not inconsistent with these regulations and shall file a copy of such directions with the Fuel Controller for Canada. The Fuel Commissioner shall forthwith mail a copy of the said directions to each dealer within the municipality by registered letter.

RESTRICTION OF COAL DELIVERIES.

(2) No dealer shall sell or deliver to a consumer and no consumer shall receive any quantity of coal which added to the quantity of such coal which such consumer may then have on hand would constitute more than an estimated supply sufficient for such percentage of such consumers' normal needs to the 31st March, 1919, as may from time to time be determined by the Fuel Administrator.

(3) When so ordered by the Fuel Administrator all dealers in any municipality selling coal direct to consumers shall require each consumer to sign a statement in Form "A" hereto.

(4) Notwithstanding the absence of any specific order under paragraph (3) by the Fuel Administrator any dealer selling coal direct to a consumer may require the said consumer to sign a statement in Form "A" hereto.

(5) The production by any dealer of a statement signed by the consumer as set forth in Form "A" hereto shall if in conformity with section (2) be *prima facie* evidence that no breach of paragraph (2) of these regulations has been made by such seller.

RESTRICTING USE OF COAL.

(6) The Fuel Commissioner with the approval of the Fuel Administrator may by registered letter issue orders to any or all fuel dealers within the municipality prohibiting such fuel dealers from supplying coal for any stated period or until otherwise directed to any individual consumer or group of consumers requiring coal for purposes not deemed vitally important.

(7) Upon the written recommendation of the Fuel Commissioner the council of any municipality may make orders governing the curtailment in the use of coal or wood in public halls or other meeting places within the municipality.

(8) Anthracite coal of what is commonly known as prepared sizes shall not be used by any industrial consumer for heating or power purposes except with the written consent of the Fuel Administrator.

(9) Whenever deemed desirable by the Fuel Administrator he may by registered letter addressed to the Fuel Commissioner or to any consumer in any town or city within his Province prohibit entirely or limit in any manner he may deem advisable the use of anthracite coal of what is commonly known as prepared sizes in any class of buildings whatsoever within such town or city.

Provided however, that the owner or agent of any building so restricted may on showing cause obtain a permit in writing signed by the Fuel Administrator to use anthracite coal without any restriction.

(10) Whenever any formal order has been issued under paragraph (9) of these regulations the Fuel Administrator shall forthwith cause a copy of such order to be inserted in at least one issue of any newspaper published in the town or city affected.

REQUISITIONING OF COAL.

(11) When in the judgment of the Fuel Commissioner an emergency exists he may, subject to the approval of the Fuel Administrator, requisition any quantity of anthracite coal in the possession of any consumer in excess of the supply permitted under paragraph (2) hereof and may direct the disposal of such excessive supply of coal.

(12) Where a requisition is made pursuant to the provisions of paragraph (11) hereof the Fuel Commissioner may authorize any local dealer to enter the premises of the consumer named therein and remove therefrom the required quantity of coal and deliver the same to such person as he may direct. Such dealer shall be liable to pay to the owner of such coal the compensation due to him under paragraph (13) hereof and may charge the person to whom it is delivered such price per ton as will reimburse him the amount of such compensation plus actual cost of delivery and profit not exceeding twenty-five cents per ton.

(13) The compensation to be paid the owner of any coal so requisitioned shall be the actual value of the said coal at retail at the time of such requisitioning or at his option the actual cost at the time of purchase plus seven per cent interest to date of requisition. In case of disagreement the decision of the Fuel Commissioner shall be final.

(14 For his information and assistance in carrying out the provisions of paragraphs (11), (12) and (13 hereof the Fuel Administrator may require the Council of any municipality:—

(*a*) To cause an immediate and independent investigation to be made into the local fuel situation and to report the result to him;

(*b*) To state by formal resolution whether or not in its opinion an emergency justifying requisitioning of coal under the preceding provisions actually exists;

(*c*) To submit to him recommendations with regard to any matter connected therewith.

DELIVERY FACILITIES.

(15) The Fuel Commissioner may by written notice directed to any fuel dealer, carter or any other person within the municipality, requisition the use of any horse, wagon, sleigh and other delivery equipment owned by or being in the custody of such person for the purpose of expediting coal deliveries during any period when an emergency is deemed by such Fuel Commissioner to exist. He shall also fix the remuneration and make directions for the use of such equipment. Failure to comply with such notice or to obey such directions shall render the offender liable to a fine not exceeding $100 for each offence or in lieu thereof imprisonment for a term not exceeding three months or to both fine and imprisonment.

REPORTS AND NOTICES.

(16) The Fuel Commissioner may by written notice require any dealer within the municipality to furnish him daily with statements showing:—

(*a*) Tonnage of coal of various classes received the previous day and total quantity on hand.

(*b*) A list of orders for coal booked by him the previous day.

(*c*) A list of coal deliveries showing quantity by class and name and address of each recipient made by him the previous day.

(*d*) The prices charged for coal so delivered.

(17) Every retail coal dealer is required to post in a prominent place in that portion of his office to which the public has access a conspicuous typewritten or printed notice containing a list of prevailing retail prices of all classes and sizes of coal handled by him with cash discounts allowed if any.

(18) Every retail coal dealer is required to notify the Fuel Commissioner of any proposed changes in the selling prices of coal or extra charges to be imposed for long haul deliveries or for any other reason or for deduction made from standard prices in connection with yard deliveries.

PROSECUTIONS AND PENALTIES.

(19) No information shall be laid by anyone excepting the Fuel Controller against any importer, dealer or broker without first submitting the facts to the Fuel Administrator and obtaining his consent in writing and in all cases where information is laid by any municipal authority under these regulations such municipality shall be entitled to receive all fines imposed in such cases.

(20) Any importer, dealer or other person contravening any of the provisions of these regulations or failing to observe any directions of the Fuel Controller or of the Fuel Administrator under these regulations or making a false statement in the form set out in paragraphs (3), (4) or (16) hereof knowing the same to be false shall upon summary conviction be guilty of an offence and unless otherwise provided be liable to a fine not exceeding $1,000 for each offence or imprisonment for a period not exceeding six months or to both fine and imprisonment.

(21) Any consumer of coal who within ten days following the receipt of any request in writing from the Provincial Fuel Administrator or from the Local Fuel Commissioner fails to furnish any information so called for respecting the fuel requirements or consumption for any specified period or respecting the heating or power equipment of any premises occupied by him or in his charge as tenant, agent or owner, or who furnishes false information in such matters to the said Fuel Administrator or Fuel Commissioner knowing the same to be false shall be guilty of an offence and on summary conviction be liable to the penalties provided under paragraph (20) hereof.

(22) Where an information is laid against any dealer or broker for an offence under paragraph (12) of these regulations the onus shall be upon the defendant to establish that the prices charged by him did not exceed those authorized by these regulations.

GENERAL.

(23) The regulations regarding the importation and sale of coal approved by Order in Council of the 20th day of March, 1918, and subsequent amendments thereto are hereby repealed.

(24) These regulations shall be in force and effect from and after the seventh day of December, 1918.

C. A. MAGRATH,
Fuel Controller.

OTTAWA, 6th December 1918.

REGULATIONS TO FIX AND CONTROL PRICES OF AND NET PROFITS UPON COAL SOLD IN CANADA.

C

Issued by the Fuel Controller for Canada.

Approved by Order in Council, 5th December, 1918, P.C. 3004.

MINE PRICES.

(1) Every operator of a coal or lignite mine in Canada outside the portions of British Columbia and Alberta known as District No. 18 shall, when required by the Fuel Controller, observe any directions he may from time to time give in writing by registered letter regarding the maximum prices per ton which the said operator may charge for the output of his mine, and containing such other terms and conditions as the Fuel Controller may deem expedient and in the public interest.

(2) No operator of any mine located outside District No. 18 shall at any time advance the prices of coal without the written authority of the Fuel Controller.

MAXIMUM PROFITS OF BROKERS AND DEALERS.

(3) The same person may act as a broker, wholesale dealer or retail dealer, that is: the nature of the transaction shall determine what charges may be made in each case.

(4) Brokers' Commissions.—A broker may charge a commission for purchasing coal not to exceed thirty cents (30c.) per net ton. No other charge or commission whatsoever shall be made by brokers.

(5) No more than one brokerage charge shall be made in Canada in respect of any coal.

(6) Wholesale Profits.—A wholesale dealer shall be permitted to charge a profit or commission not to exceed the sum of thirty-five cents (35c.) per net ton of coal sold by him and physically handled over and above the average cost price to such wholesale dealer of the said coal delivered in his yard, and may also add to such cost price a reasonable proportion of the cost of handling and a reasonable proportion of his overhead expenses and fixed charges.

(7) Not more than one wholesale charge shall be made in Canada in respect of any coal, and no coal shall there be allowed both a charge for brokerage in Canada and a wholesale charge unless under special circumstances and with the written consent of the Fuel Controller.

(8) Retail Profits.—Retail dealers shall be permitted to charge a profit not to exceed fifty cents (50c.) per net ton on any coal over and above the average cost price to such retail dealers of the said coal and including a reasonable proportion of the cost of handling and a reasonable proportion of the overhead expenses and fixed charges. On the sale of any quantity of coal less than one net ton the same proportionate profit may be charged except that on any quantity less than two hundred pounds a profit of five cents (5c.) may be charged.

(9) No dealer shall add to the price of coal to consumers both a wholesale and a retail profit.

COMPETITIVE SELLING.

(10) These regulations shall not prevent any operator, dealer or broker from selling any coal at a price less than the maximum at which he is permitted to sell under these regulations.

CALCULATING COST PRICES.

(11) The maximum price at which any size and grade of coal may be sold by a dealer during the period from the first day to the fifteenth day of any month, both inclusive, shall be the average delivered cost price to such dealer of such size and grade of coal on hand on the first day of such month plus a reasonable proportion of the cost of handling plus a reasonable proportion of overhead expenses and fixed charges plus a profit not exceeding that permitted in the preceding paragraphs. Similarly from the sixteenth day to the last day of any month, both inclusive, the maximum price shall be based upon the average cost of coal on hand on the sixteenth day of the month.

(12) On the recommendation of any Fuel Administrator the Fuel Controller may direct that the cost of coal within his province shall be computed at the beginning of each month, instead of on the 1st and 16th as directed in paragraph (11).

(13) Retail coal dealers may average the cost to them of the different sizes of anthracite coal larger than pea, but on all other sizes and grades of coal the cost must be determined separately as directed in paragraph (11).

CALCULATING OVERHEAD COST.

(14) In calculating overhead charges to determine the cost of coal, no dealer is to include either directly or indirectly any charge, expense or cost in connection with any of the following:—

(a) Interest on any money invested in land, plant, equipment or other assets in so far as any of these concerns the coal business.

(b) Interest on bonds, debentures, other funded debt or borrowed money. A charge may, however, be made by retail dealers to cover interest on bona fide outstanding customers' accounts at prevailing bank rate.

(c) Charges to sinking fund to redeem bonds, debentures or other debt.

(d) Income tax, excess profit or other business tax. This does not include any tax collected by the Department of Customs and Inland Revenue on coal imported from the United States of America.

(e) Outlay on permanent improvements, equipment or other capital account expenditure.

(f) Rental charges for yards, plant or equipment.

(15) Salaries and expenses to officers or partners are not to be increased over those prevailing during the year 1914 at a greater rate than salaries in other lines of business have increased. A dealer may charge his business with his own salary, but a reasonable rate only.

(16) Depreciation may be charged at regular periods on the wear and tear to buildings, structures or equipment, so that at the end of the life of any such building, structure or equipment, or when the same becomes obsolete, a fund will have been provided equal to the original investment and based upon the estimated life of the building, structures or equipment, from the date the asset was acquired or built.

(17) If a dealer makes any charge for shortage of tonnage in arriving at his selling price of coal, such charge is to be determined by actual computation and is not to be estimated.

(18) If a dealer screens any coal and sells the slack coal or screenings resulting from such screening operation at a less price than the selling price as herein authorized, the difference between such prices may be distributed proportionately over the cost of the prepared sizes of coal which resulted from such screening operations.

(19) Dealers conducting a retail as well as a wholesale business, must apportion their overhead expenses and fixed charges to each such branch, and such apportionment must bear reasonable comparison with the average overhead expenses and fixed charges of dealers who are engaged entirely in a retail or entirely in a wholesale business.

(20) All coal sold to consumers is to bear the same proportion of overhead expenses and fixed charges per net ton, and a dealer is not permitted to apportion his overhead expenses and fixed charges more heavily on any one class, grade or size of coal than on another.

(21) Discounts or rebates for cash or for any other consideration that may be allowed to a customer by any dealer are not to be considered a charge against overhead expenses and fixed charges in computing the selling price of coal.

FIXING MAXIMUM CHARGES.

(22) On the recommendation of the Fuel Administrator the Fuel Controller may fix maximum receiving, yard, delivery and overhead charges for any municipality by notification to the Fuel Commissioner through the Fuel Administrator.

RETURNS AND ACCESS TO RECORDS.

(23) The Fuel Controller or his duly authorized agent shall have access to all books, records, documents and papers of any kind whatsoever relating directly or indirectly to the business affairs of any operator, dealer or importer, and all such persons shall supply the Fuel Controller or his agent with all information and statements as and when required by the said Fuel Controller or his agent. Any such person failing to give such information when so demanded, or giving false information knowing the same to be false, shall be guilty of an offence, and on summary conviction subject to the penalty provided under paragraph (28). A further penalty not exceeding $100 per day for each day of the period of such default may also be imposed.

(24) The officer in charge of the Fuel Section of the Dominion Bureau of Statistics or his representative is hereby constituted a duly authorized agent of the Fuel Controller.

(25) In the event of failure to furnish information under paragraph (23) of any operator, dealer or importer, the Fuel Controller or his duly authorized agent is hereby empowered to cause all such books, records, documents and papers relating to the business of any such defaulter to be seized wherever they may be and placed in his custody. Any person having in his possession and failing upon demand in writing by the Fuel Controller or his agent to surrender any books, records, documents and papers as demanded, shall upon summary conviction be guilty of an offence and subject to the penalty provided under paragraph (28).

PROSECUTIONS AND PENALTIES.

(26) No information shall be laid by anyone excepting the Fuel Controller against any importer, dealer or broker without first submitting the facts to the Fuel Administrator and obtaining his consent in writing, and in all cases where information is laid by any municipal authority under these regulations such municipality shall be entitled to receive all fines imposed in such cases.

(27) It shall be the duty of the Fuel Commissioner to receive and investigate any complaint made to him in writing by any person respecting alleged infractions of these regulations by any dealer within his municipality, and to promptly submit a report to the Provincial Fuel Administrator upon any such complaint investigated together with a recommendation as to whether or not formal proceedings should in his judgment be taken and in any case where legal prosecution is formally authorized by the Fuel Administrator as herein provided, the said Fuel Commissioner shall forthwith bring all the facts in his possession to the attention of the municipal authorities for further action.

(28) Any importer, dealer or other person contravening any of the provisions of these regulations or of any agreement entered into with the Fuel Controller, or failing to observe any directions of the Fuel Controller under paragraph (1), or failing to obey any order of the Fuel Administrator under these regulations, shall upon summary conviction be guilty of an offence, and unless otherwise provided be liable to a fine not exceeding $5,000 for each offence, or in lieu thereof imprisonment for a period not exceeding six months, or to both fine and imprisonment.

(29) Where an information is laid against any operator, dealer or broker for an offence under paragraphs (1), (4), (6) or (8) of these regulations, the onus shall be upon the defendant to establish that the prices charged by him did not exceed those authorized herein.

(30) Any director or officer of any company or corporation who assents to or acquieces in the contravention or non-observance by such company or corporation of any of the provisions of these regulations shall be guilty personally and cumulatively with his company or corporation and with his co-directors or associate officers.

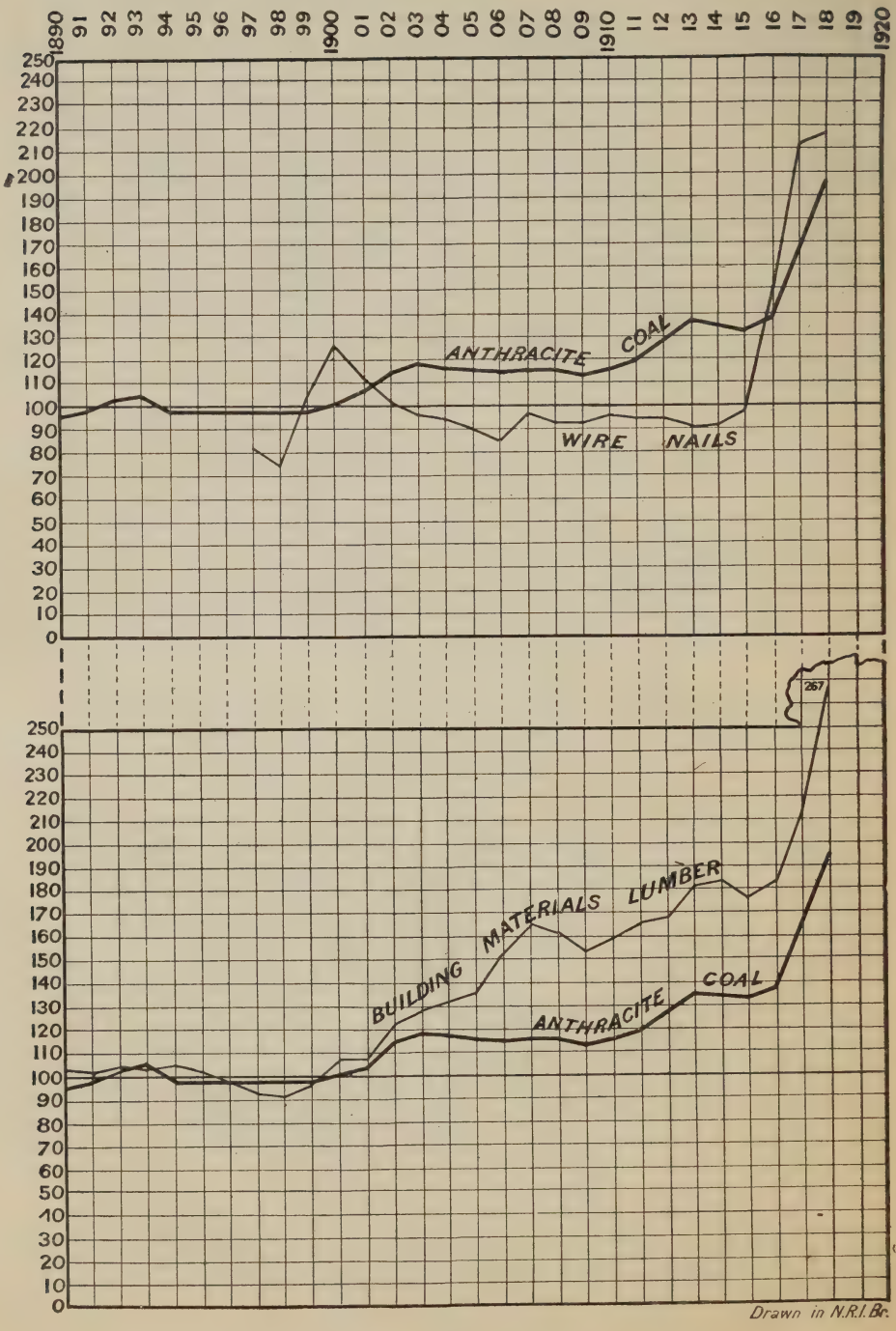
(31) These regulations shall be in force and effect from and after the seventh day of December, 1918.

C. A. MAGRATH,
Fuel Controller.

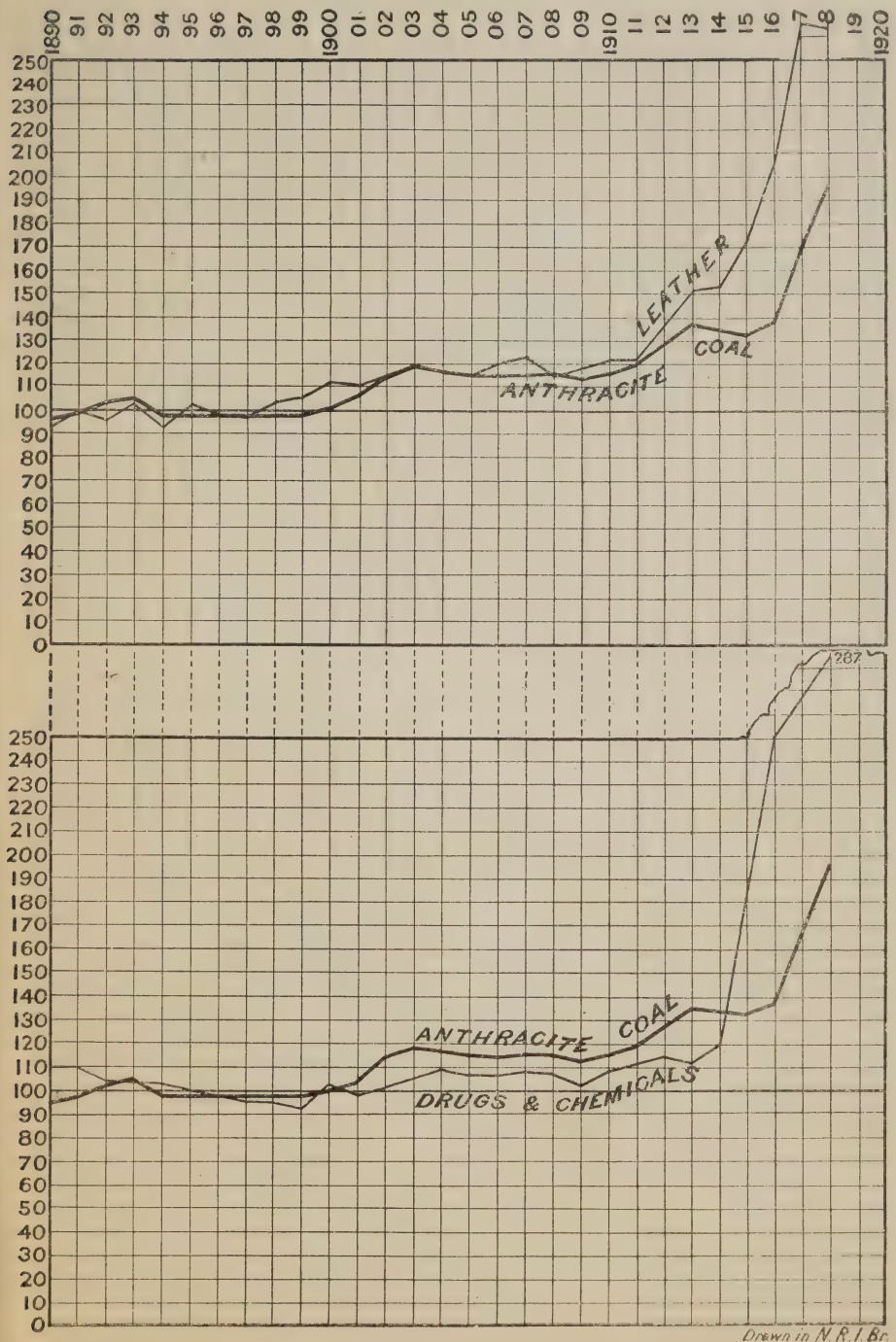
Ottawa, 7th December, 1918.

(E)

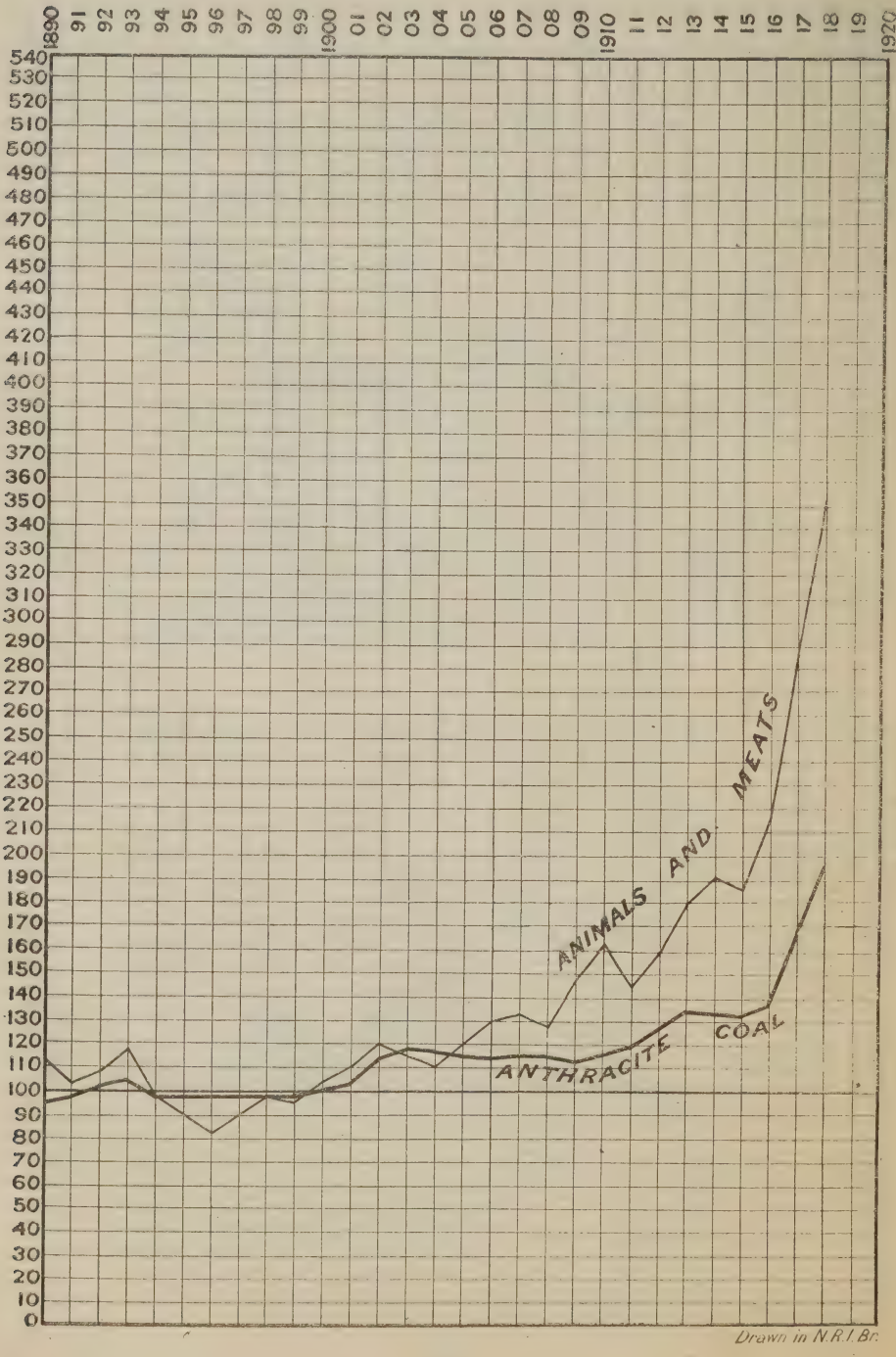
RELATIVE PRICE INDICES OF REPRESENTATIVE COMMODITIES



Relative Price Indices of Representative Commodities



RELATIVE PRICE INDICES OF REPRESENTATIVE COMMODITIES



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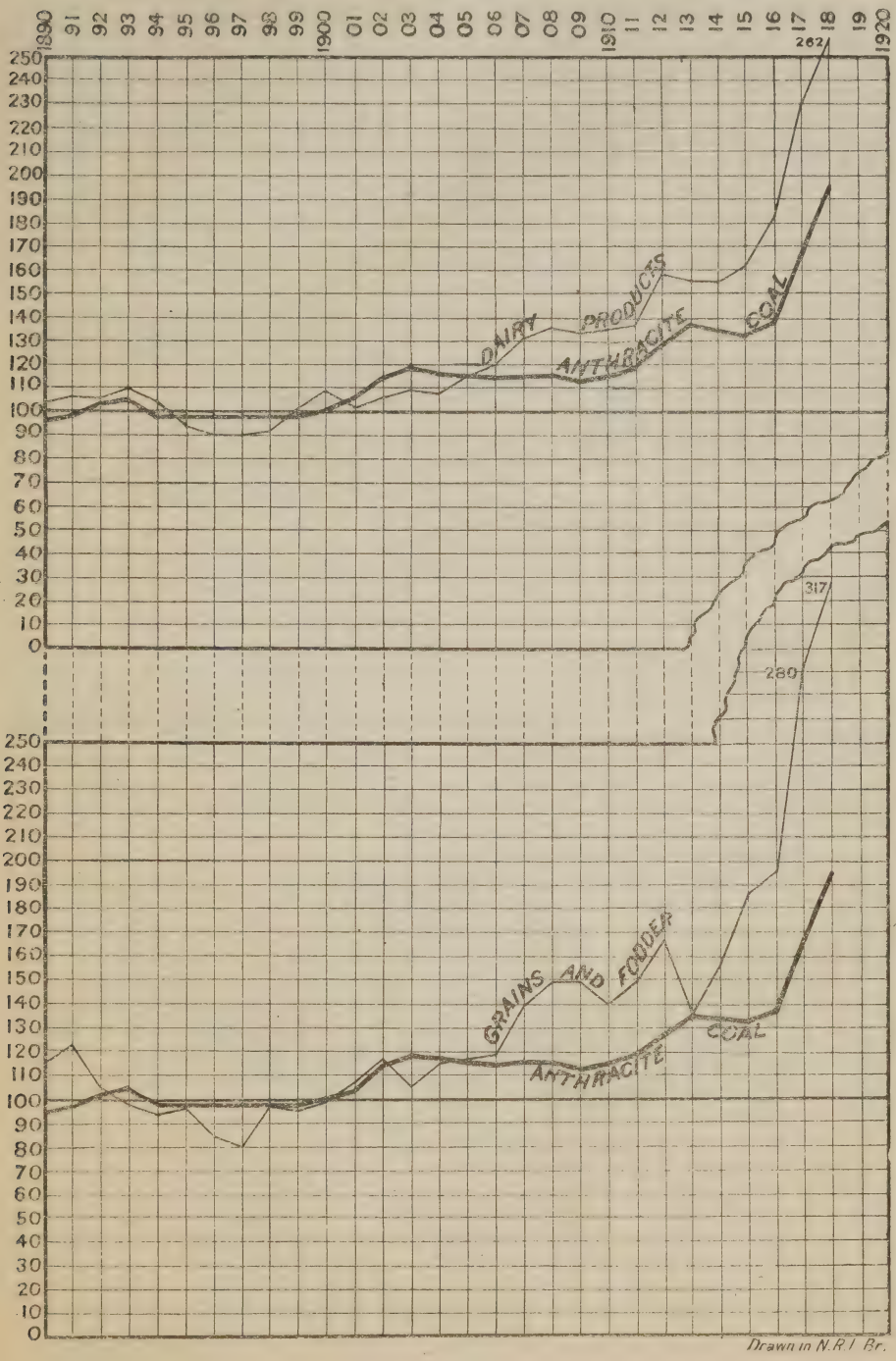

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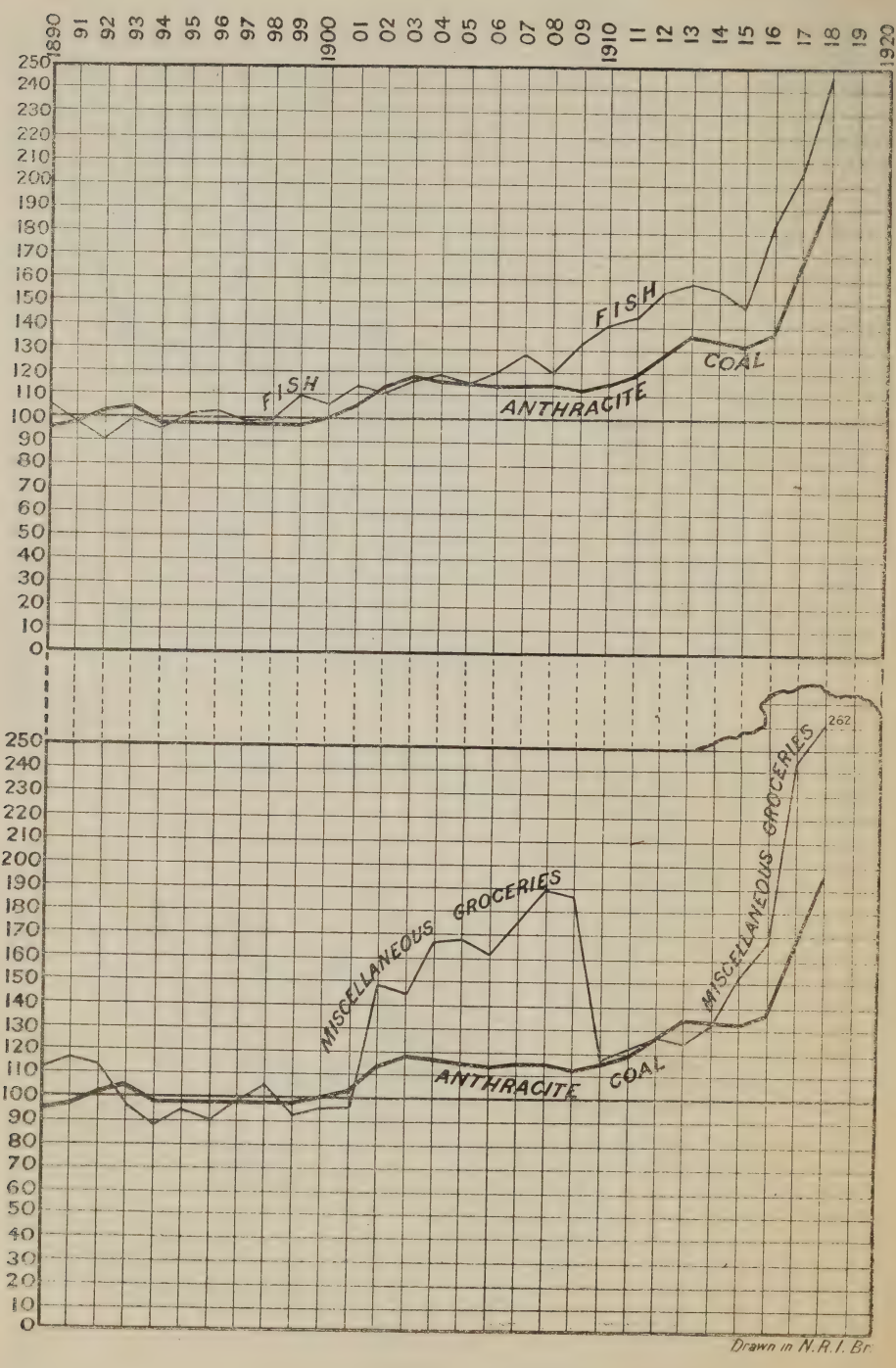
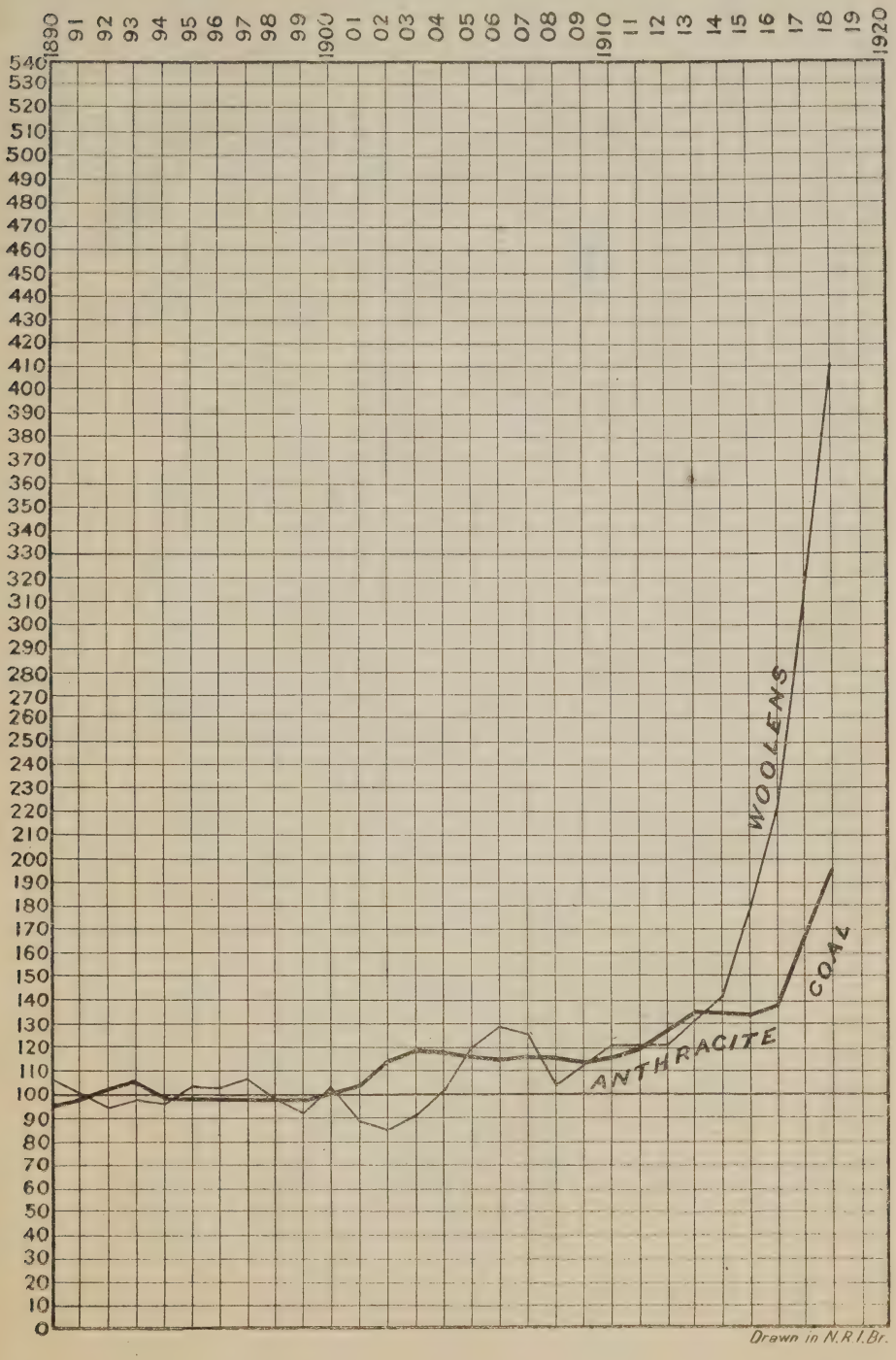
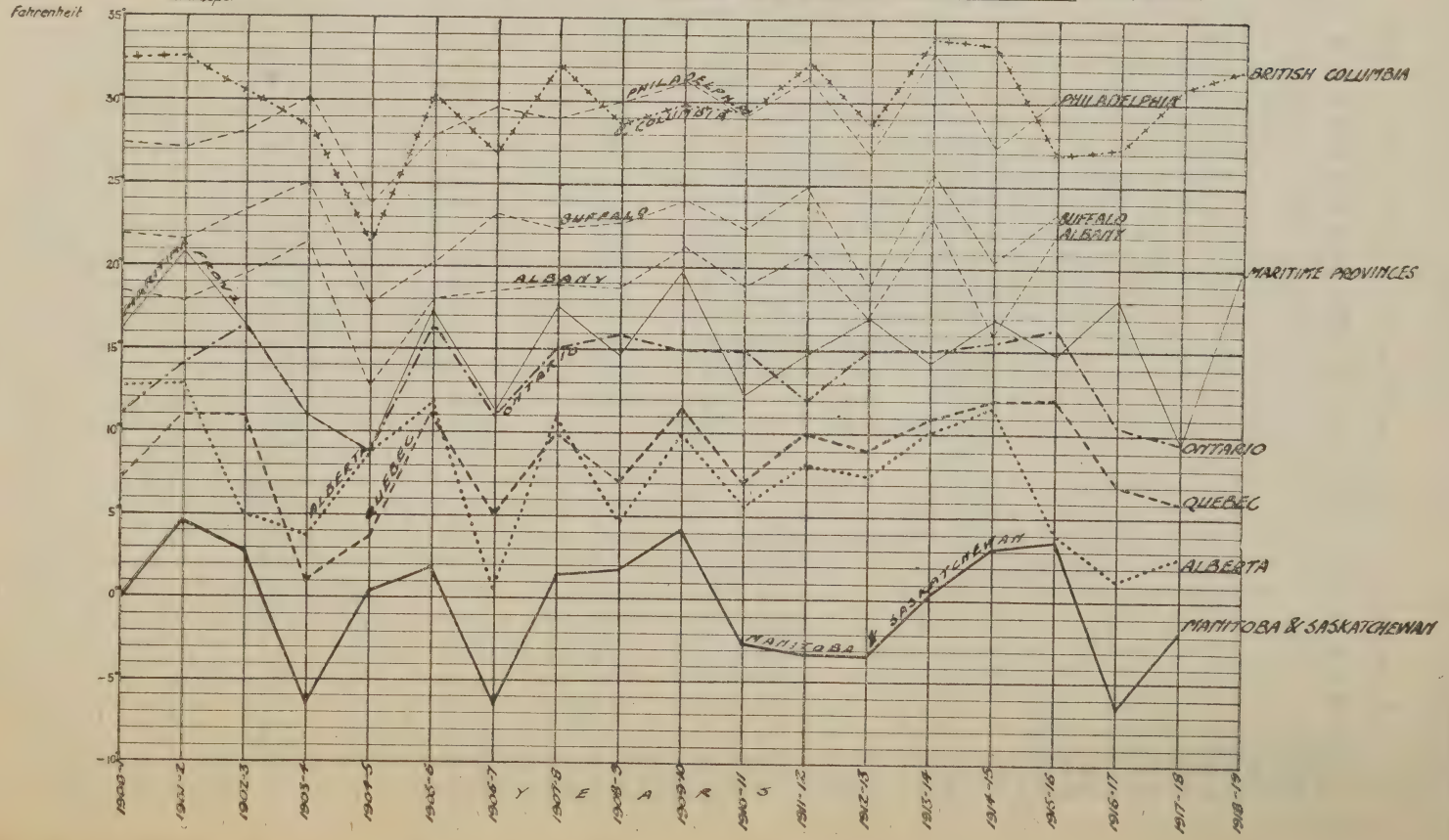


Relative Price Indices of Representative Commodities.



Mean minimum Winter temperature by Provinces in Canada and at representative points in the United States Years 1900-18

Note: Curves based on temperatures for months Dec., Jan. Feb. Mar. at following points: In MARITIME PROVINCES. St John, Fredericton, Halifax, Sydney, Charlottetown. In QUEBEC. Quebec, Montreal, Father Point, Sherbrooke. In ONTARIO. Toronto, Ottawa, Kingston, London, Peterboro. In MANITOBA AND SASKATCHEWAN Winnipeg, Minnedosa, Moose Jaw, Prince Albert, Swift Current. IN ALBERTA. Calgary, Medicine Hat, Edmonton. BRITISH COLUMBIA Victoria, Vancouver Kamloops.



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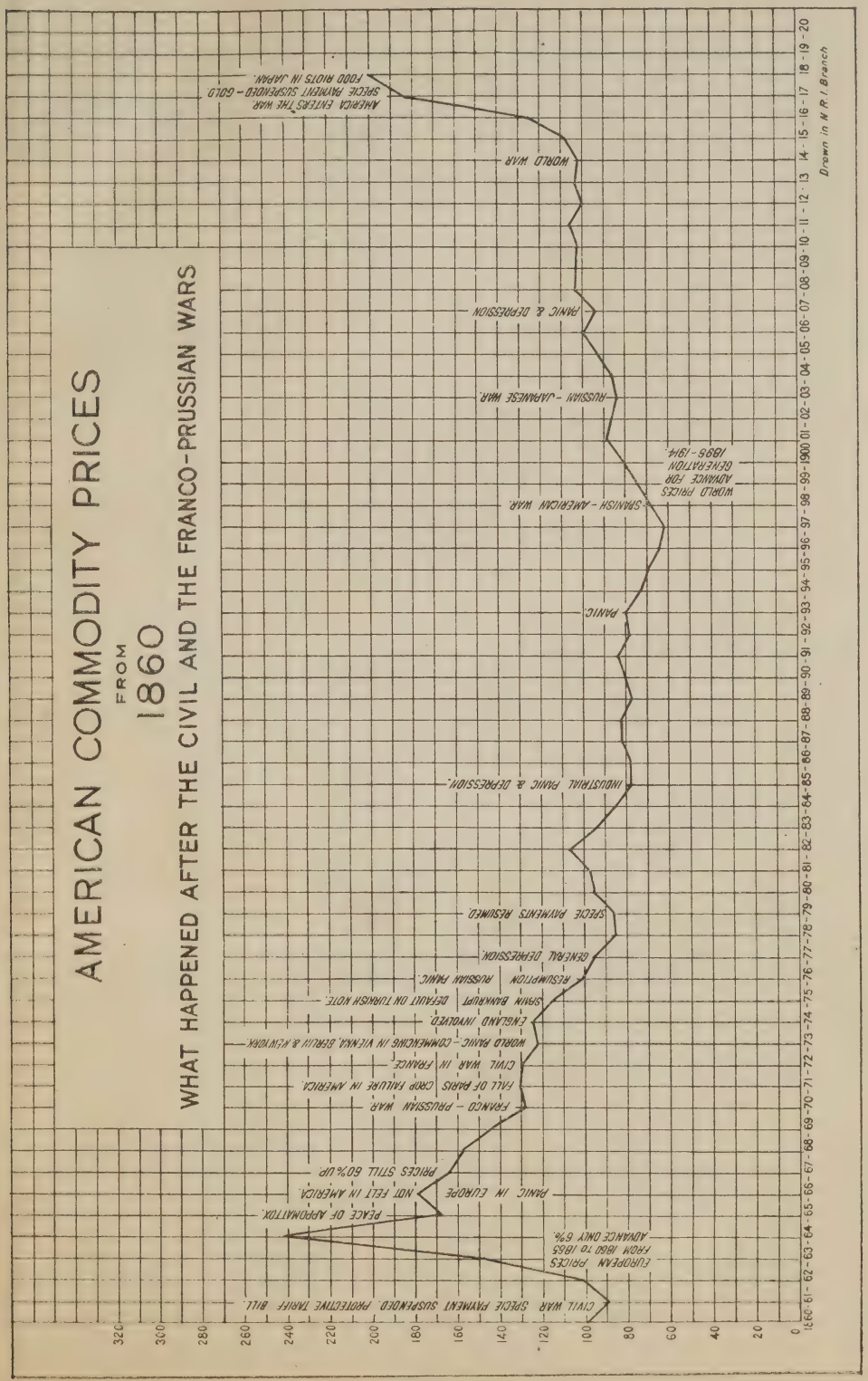
AMERICAN COMMODITY PRICES
FROM
1860
WHAT HAPPENED AFTER THE CIVIL AND THE FRANCO-PRUSSIAN WARS
Drawn in N.R.I. Branch
CIVIL WAR SPECIE PAYMENT SUSPENDED PROTECTIVE TARIFF BILL
EUROPEAN PRICES FROM 1860 TO 1865 ADVANCE ONLY 6%
PEACE OF APPOMATTOX
PANIC IN EUROPE NOT FELT IN AMERICA
PRICES STILL 60% UP
FRANCO - PRUSSIAN WAR
FALL OF PARIS CROP FAILURE IN AMERICA
CIVIL WAR IN FRANCE
WORLD PANIC - COMMENCING IN VIENNA, BERLIN & N.Y. YORK
ENGLAND INVOLVED
SPAIN BANKRUPT DEFAULT ON TURKISH NOTE
RESUMPTION RUSSIAN PANIC
GENERAL DEPRESSION
SPECIE PAYMENTS RESUMED
INDUSTRIAL PANIC & DEPRESSION
PANIC
SPANISH - AMERICAN WAR
WORLD PRICES ADVANCE FOR GENERATION 1895 - 1914
RUSSIAN - JAPANESE WAR
PANIC & DEPRESSION
WORLD WAR
AMERICA ENTERS THE WAR SPECIE PAYMENT SUSPENDED - GOLD FOOD RIOTS IN JAPAN
320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0
1861 - 62 - 63 - 64 - 65 - 66 - 67 - 68 - 69 - 70 - 71 - 72 - 73 - 74 - 75 - 76 - 77 - 78 - 79 - 80 - 81 - 82 - 83 - 84 - 85 - 86 - 87 - 88 - 89 - 90 - 91 - 92 - 93 - 94 - 95 - 96 - 97 - 98 - 99 - 1900 01 - 02 - 03 - 04 - 05 - 06 - 07 - 08 - 09 - 10 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 18 - 19 - 20

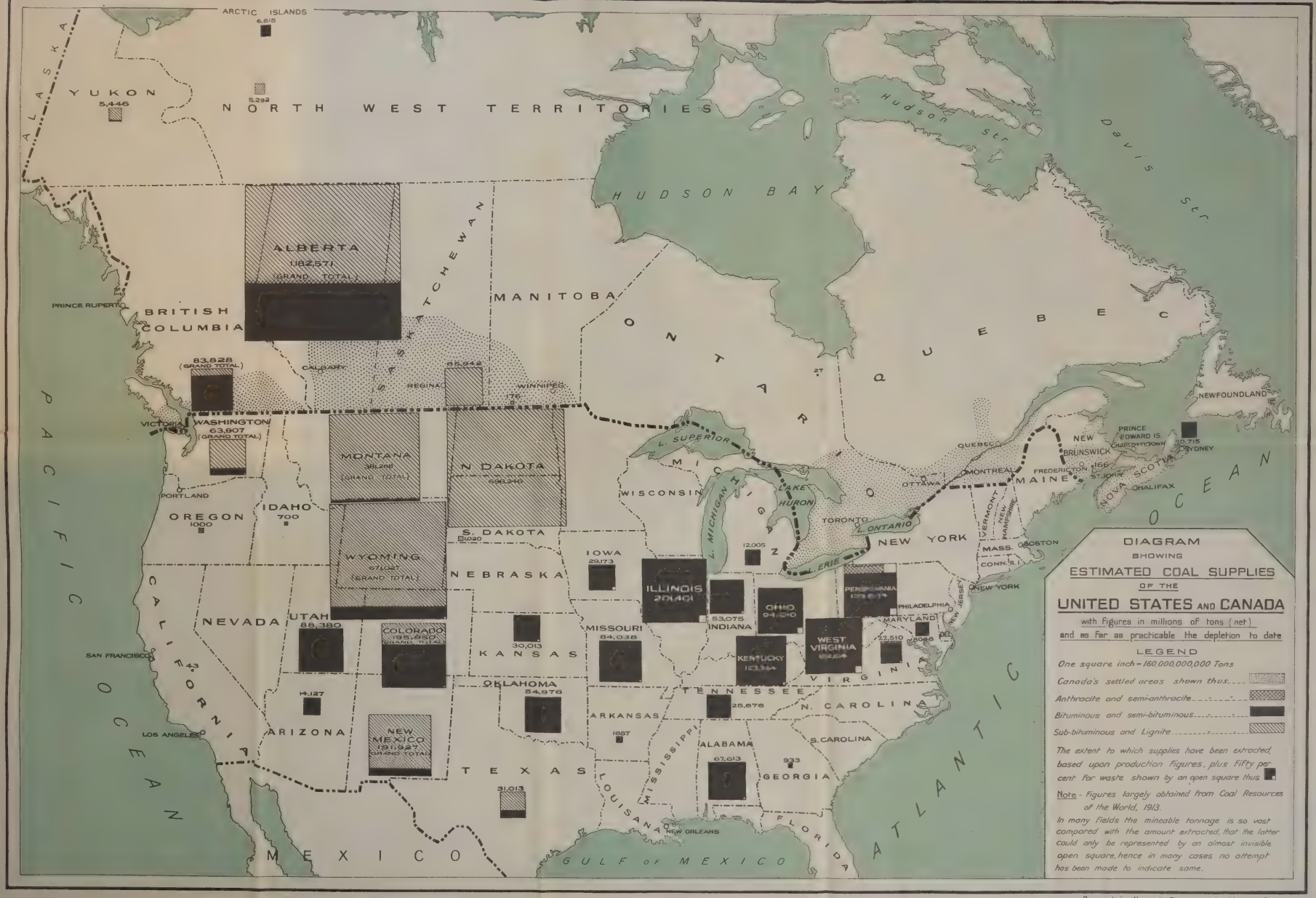

DIAGRAM
SHOWING
ESTIMATED COAL SUPPLIES
OF THE
UNITED STATES AND CANADA
with Figures in millions of tons (net)
and as far as practicable the depletion to date

LEGEND

One square inch = 160,000,000,000 Tons

Canada's settled areas shown thus.....

Anthracite and semi-anthracite.....

Bituminous and semi-bituminous.....

Sub-bituminous and Lignite.....

The extent to which supplies have been extracted, based upon production Figures, plus Fifty per cent for waste shown by an open square thus ■

Note - Figures largely obtained from Coal Resources of the World, 1913.

In many fields the mineable tonnage is so vast compared with the amount extracted, that the latter could only be represented by an almost invisible open square, hence in many cases no attempt has been made to indicate same.

Prepared in Natural Resources Intelligence Branch